Encyclopædia
of
Religion and Ethics

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LISTS OF ABBREVIATIONS

I. General

A.H. = Anno Hijrae (A.D. 622).
Ak. = Akkadian.
Alex. = Alexandrian.
Amer. = American.
Apoc. = Apocalypse, Apocalyptic.
Apocr. = Apocrypha.
Aq. = Aquila.
Arab. = Arabic.
Aram. = Aramaic.
Arm. = Armenian.
Ary. = Aryan.
As. = Asiatic.
Assyr. = Assyrian.
AT = Altes Testament.
AV = Authorized Version.
AVm = Authorized Version margin.
A.Y. = Anno Yazdagird (A.D. 639).
Bab. = Babylonian.
c. = *circa*, about.
Can. = Canaanite.
cf. = compare.
ct. = contrast.
D = Deuteronomist.
E = Elohist.
edd. = editions or editors.
Egyp. = Egyptian.
Eng. = English.
Eth. = Ethiopic.
EV, EVV = English Version, Versions.
f. = and following verse or page.
ff. = and following verses or pages.
Fr. = French.
Germ. = German.
Gr. = Greek.
H = Law of Holiness.
Heb. = Hebrew.
Hel. = Hellenistic.
Hex. = Hexateuch.
Himy. = Himyaritic.
Ir. = Irish.
Iran. = Iranian.
Isr. = Israelite.
J = Jahwist.
J″ = Jehovah.
Jerus. = Jerusalem.
Jos. = Josephus.
LXX = Septuagint.
Min. = Minæan.
MSS = Manuscripts.
MT = Massoretic Text.
n. = note.
NT = New Testament.
Onḳ. = Onḳelos.
OT = Old Testament.
P = Priestly Narrative.
Pal. = Palestine, Palestinian.
Pent. = Pentateuch.
Pers. = Persian.
Phil. = Philistine.
Phœn. = Phœnician.
Pr. Bk. = Prayer Book.
R = Redactor.
Rom. = Roman.
RV = Revised Version.
RVm = Revised Version margin.
Sab. = Sabæan.
Sam. = Samaritan.
Sem. = Semitic.
Sept. = Septuagint.
Sin. = Sinaitic.
Skr. = Sanskrit.
Symm. = Symmachus.
Syr. = Syriac.
t. (following a number) = times.
Talm. = Talmud.
Targ. = Targum.
Theod. = Theodotion.
TR = Textus Receptus, Received Text.
tr. = translated or translation.
VSS = Versions.
Vulg., Vg. = Vulgate.
WH = Westcott and Hort's text.

II. Books of the Bible

Old Testament.

Gn = Genesis.
Ex = Exodus.
Lv = Leviticus.
Nu = Numbers.
Dt = Deuteronomy.
Jos = Joshua.
Jg = Judges.
Ru = Ruth.
1 S, 2 S = 1 and 2 Samuel.
1 K, 2 K = 1 and 2 Kings.
1 Ch, 2 Ch = 1 and 2 Chronicles.
Ezr = Ezra.
Neh = Nehemiah.
Est = Esther.
Job.
Ps = Psalms.
Pr = Proverbs.
Ec = Ecclesiastes.
Ca = Canticles.
Is = Isaiah.
Jer = Jeremiah.
La = Lamentations.
Ezk = Ezekiel.
Dn = Daniel.
Hos = Hosea.
Jl = Joel.
Am = Amos.
Ob = Obadiah.
Jon = Jonah.
Mic = Micah.
Nah = Nahum.
Hab = Habakkuk.
Zeph = Zephaniah.
Hag = Haggai.
Zec = Zechariah.
Mal = Malachi.

Apocrypha.

1 Es, 2 Es = 1 and 2 Esdras.
To = Tobit.
Jth = Judith.
Ad. Est = Additions to Esther.
Wis = Wisdom.
Sir = Sirach or Ecclesiasticus.
Bar = Baruch.
Three = Song of the Three Children.
Sus = Susanna.
Bel = Bel and the Dragon.
Pr. Man = Prayer of Manasses.
1 Mac, 2 Mac = 1 and 2 Maccabees.

New Testament.

Mt = Matthew.
Mk = Mark.
Lk = Luke.
Jn = John.
Ac = Acts.
Ro = Romans.
1 Co, 2 Co = 1 and 2 Corinthians.
Gal = Galatians.
Eph = Ephesians.
Ph = Philippians.
Col = Colossians.
1 Th, 2 Th = 1 and 2 Thessalonians.
1 Ti, 2 Ti = 1 and 2 Timothy.
Tit = Titus.
Philem = Philemon.
He = Hebrews.
Ja = James.
1 P, 2 P = 1 and 2 Peter.
1 Jn, 2 Jn, 3 Jn = 1, 2, and 3 John.
Jude.
Rev = Revelation.

III. For the Literature

1. The following authors' names, when unaccompanied by the title of a book, stand for the works in the list below.

Baethgen = *Beiträge zur sem. Religionsgesch.*, 1888.
Baldwin = *Dict. of Philosophy and Psychology*, 3 vols. 1901–05.
Barth = *Nominalbildung in den sem. Sprachen*, 2 vols. 1889, 1891 (^{2}1894).
Benzinger = *Heb. Archäologie*, 1894.
Brockelmann = *Gesch. d. arab. Litteratur*, 2 vols. 1897–1902.
Bruns-Sachau = *Syr.-Röm. Rechtsbuch aus dem fünften Jahrhundert*, 1880.
Budge = *Gods of the Egyptians*, 2 vols. 1903.
Daremberg-Saglio = *Dict. des ant. grec. et rom.*, 1886–90.
De la Saussaye = *Lehrbuch der Religionsgesch.*^{3}, 1905.
Denzinger = *Enchiridion Symbolorum*^{11}, Freiburg im Br., 1911.
Deussen = *Die Philos. d. Upanishads*, 1899 [Eng. tr., 1906].
Doughty = *Arabia Deserta*, 2 vols. 1888.
Grimm = *Deutsche Mythologie*^{4}, 3 vols. 1875–78, Eng. tr. *Teutonic Mythology*, 4 vols. 1882–88.
Hamburger = *Realencyclopädie für Bibel u. Talmud*, i. 1870 (^{2}1892), ii. 1883, suppl. 1886, 1891 f., 1897.
Holder = *Altceltischer Sprachschatz*, 1891 ff.
Holtzmann-Zöpffel = *Lexicon f. Theol. u. Kirchenwesen*^{2}, 1895.
Howitt = *Native Tribes of S.E. Australia*, 1904.
Jubainville = *Cours de Litt. celtique*, i.–xii., 1883 ff.
Lagrange = *Études sur les religions sémitiques*^{2}, 1904.
Lane = *An Arabic-English Lexicon*, 1863 ff.
Lang = *Myth, Ritual, and Religion*^{2}, 2 vols. 1899.
Lepsius = *Denkmäler aus Aegypten u. Aethiopien*, 1849–60.
Lichtenberger = *Encyc. des sciences religieuses*, 1876.
Lidzbarski = *Handbuch der nordsem. Epigraphik*, 1898.
McCurdy = *History, Prophecy, and the Monuments*, 2 vols. 1894–96.
Muir = *Orig. Sanskrit Texts*, 1858–72.
Muss-Arnolt = *A Concise Dict. of the Assyrian Language*, 1894 ff.
Nowack = *Lehrbuch d. heb. Archäologie*, 2 vols. 1894.
Pauly-Wissowa = *Realencyc. der classischen Altertumswissenschaft*, 1894 ff.
Perrot-Chipiez = *Hist. de l'art dans l'antiquité*, 1881 ff.
Preller = *Römische Mythologie*, 1858.
Réville = *Religion des peuples non-civilisés*, 1883.
Riehm = *Handwörterbuch d. bibl. Altertums*^{2}, 1893–94.
Robinson = *Biblical Researches in Palestine*^{2}, 1856.
Roscher = *Lex. d. gr. u. röm. Mythologie*, 1884 ff.
Schaff-Herzog = *The New Schaff-Herzog Encyclopedia of Religious Knowledge*, 1908 ff.
Schenkel = *Bibel-Lexicon*, 5 vols. 1869–75.
Schürer = *GJV*^{3}, 3 vols. 1898–1901 [*HJP*, 5 vols. 1890 ff.].
Schwally = *Leben nach dem Tode*, 1892.
Siegfried-Stade = *Heb. Wörterbuch zum AT*, 1893.
Smend = *Lehrbuch der alttest. Religionsgesch.*^{2}, 1899.
Smith (G. A.) = *Historical Geography of the Holy Land*^{4}, 1897.
Smith (W. R.) = *Religion of the Semites*^{2}, 1894.
Spencer (H.) = *Principles of Sociology*^{3}, 1885–96.
Spencer-Gillen^{a} = *Native Tribes of Central Australia*, 1899.
Spencer-Gillen^{b} = *Northern Tribes of Central Australia*, 1904.
Swete = *The OT in Greek*, 3 vols. 1893 ff.
Tylor (E. B.) = *Primitive Culture*^{3}, 1891 [^{4}1903].
Ueberweg = *Hist. of Philosophy*, Eng. tr., 2 vols. 1872–74.
Weber = *Jüdische Theologie auf Grund des Talmud u. verwandten Schriften*^{2}, 1897.
Wiedemann = *Die Religion der alten Aegypter*, 1890 [Eng. tr., revised, *Religion of the Anc. Egyptians*, 1897].
Wilkinson = *Manners and Customs of the Ancient Egyptians*, 3 vols. 1878.
Zunz = *Die gottesdienstlichen Vorträge der Juden*^{2}, 1892.

2. Periodicals, Dictionaries, Encyclopædias, and other standard works frequently cited.

AA = Archiv für Anthropologie.
AAOJ = American Antiquarian and Oriental Journal.
ABAW = Abhandlungen d. Berliner Akad. d. Wissenschaften.
AE = Archiv für Ethnographie.
AEG = Assyr. and Eng. Glossary (Johns Hopkins University).
AGG = Abhandlungen der Göttinger Gesellschaft der Wissenschaften.
AGPh = Archiv für Geschichte der Philosophie.
AHR = American Historical Review.
AHT = Ancient Hebrew Tradition (Hommel).
AJPh = American Journal of Philology.
AJPs = American Journal of Psychology.
AJRPE = American Journal of Religious Psychology and Education.
AJSL = American Journal of Semitic Languages and Literature.
AJTh = American Journal of Theology.
AMG = Annales du Musée Guimet.
APES = American Palestine Exploration Society.
APF = Archiv für Papyrusforschung.
AR = Anthropological Review.
ARW = Archiv für Religionswissenschaft.
AS = Acta Sanctorum (Bollandus).
ASG = Abhandlungen der Sächsischen Gesellschaft der Wissenschaften.
ASoc = L'Année Sociologique.
ASWI = Archæological Survey of W. India.
AZ = Allgemeine Zeitung.
BAG = Beiträge zur alten Geschichte.
BASS = Beiträge zur Assyriologie u. sem. Sprachwissenschaft (edd. Delitzsch and Haupt).
BCH = Bulletin de Correspondance Hellénique.
BE = Bureau of Ethnology.
BG = Bombay Gazetteer.
BJ = Bellum Judaicum (Josephus).
BL = Bampton Lectures.
BLE = Bulletin de Littérature Ecclésiastique.
BOR = Bab. and Oriental Record.
BS = Bibliotheca Sacra.
BSA = Annual of the British School at Athens.
BSAA = Bulletin de la Soc. archéologique à Alexandrie.
BSAL = Bulletin de la Soc. d'Anthropologie de Lyon.
BSAP = Bulletin de la Soc. d'Anthropologie, etc., Paris.
BSG = Bulletin de la Soc. de Géographie.
BTS = Buddhist Text Society.
BW = Biblical World.
BZ = Biblische Zeitschrift.

CAIBL=Comptes rendus de l'Académie des Inscriptions et Belles-Lettres.
CBTS=Calcutta Buddhist Text Society.
CE=Catholic Encyclopædia.
CF=Childhood of Fiction (MacCulloch).
CGS=Cults of the Greek States (Farnell).
CI=Census of India.
CIA=Corpus Inscrip. Atticarum.
CIE=Corpus Inscrip. Etruscarum.
CIG=Corpus Inscrip. Græcarum.
CIL=Corpus Inscrip. Latinarum.
CIS=Corpus Inscrip. Semiticarum.
COT=Cuneiform Inscriptions and the OT [Eng. tr. of *KAT*^{2}; see below].
CR=Contemporary Review.
CeR=Celtic Review.
ClR=Classical Review.
CQR=Church Quarterly Review.
CSEL=Corpus Script. Eccles. Latinorum.
DAC=Dict. of the Apostolic Church.
DACL = Dict. d'Archéologie chrétienne et de Liturgie (Cabrol).
DB=Dict. of the Bible.
DCA=Dict. of Christian Antiquities (Smith–Cheetham).
DCB=Dict. of Christian Biography (Smith–Wace).
DCG=Dict. of Christ and the Gospels.
DI=Dict. of Islam (Hughes).
DNB=Dict. of National Biography.
DPhP=Dict. of Philosophy and Psychology.
DWAW=Denkschriften der Wiener Akad. der Wissenschaften.
EBi=Encyclopædia Biblica.
EBr=Encyclopædia Britannica.
EEFM=Egyp. Explor. Fund Memoirs.
EI=Encyclopaedia of Islām.
ERE=The present work.
Exp=Expositor.
ExpT=Expository Times.
FHG=Fragmenta Historicorum Græcorum (coll. C. Müller, Paris, 1885).
FL=Folklore.
FLJ=Folklore Journal.
FLR=Folklore Record.
GA=Gazette Archéologique.
GB=Golden Bough (Frazer).
GGA=Göttingische Gelehrte Anzeigen.
GGN=Göttingische Gelehrte Nachrichten (Nachrichten der königl. Gesellschaft der Wissenschaften zu Göttingen).
GIAP=Grundriss d. Indo-Arischen Philologie.
GIrP=Grundriss d. Iranischen Philologie.
GJV=Geschichte des jüdischen Volkes.
GVI=Geschichte des Volkes Israel.
HAI=Handbook of American Indians.
HDB=Hastings' Dict. of the Bible.
HE=Historia Ecclesiastica.
HGHL=Historical Geography of the Holy Land (G. A. Smith).
HI=History of Israel.
HJ=Hibbert Journal.
HJP=History of the Jewish People.
HL=Hibbert Lectures.
HN=Historia Naturalis (Pliny).
HWB=Handwörterbuch.
IA=Indian Antiquary.
ICC=International Critical Commentary.
ICO=International Congress of Orientalists.
ICR=Indian Census Report.
IG=Inscrip. Græcæ (publ. under auspices of Berlin Academy, 1873 ff.).
IGA=Inscrip. Græcæ Antiquissimæ.
IGI=Imperial Gazetteer of India^2 (1885); new edition (1908–09).
IJE=International Journal of Ethics.
ITL=International Theological Library.
JA=Journal Asiatique.
JAFL=Journal of American Folklore.
JAI=Journal of the Anthropological Institute.
JAOS=Journal of the American Oriental Society.
JASB=Journal of the Anthropological Society of Bombay.
JASBe=Journ. of As. Soc. of Bengal.
JBL=Journal of Biblical Literature.
JBTS=Journal of the Buddhist Text Society.
JD=Journal des Débats.
JDTh=Jahrbücher f. deutsche Theologie.
JE=Jewish Encyclopedia.
JGOS=Journal of the German Oriental Society.
JHC=Johns Hopkins University Circulars.
JHS=Journal of Hellenic Studies.
JLZ=Jenäer Litteraturzeitung.
JPh=Journal of Philology.
JPTh=Jahrbücher für protestantische Theologie.
JPTS=Journal of the Pāli Text Society.
JQR=Jewish Quarterly Review.
JRAI=Journal of the Royal Anthropological Institute.
JRAS=Journal of the Royal Asiatic Society.
JRASBo=Journal of the Royal Asiatic Society, Bombay branch.
JRASC=Journal of the Royal Asiatic Society, Ceylon branch.
JRASK=Journal of the Royal Asiatic Society, Korean branch.
JRGS=Journal of the Royal Geographical Society.
JRS=Journal of Roman Studies.
JThSt=Journal of Theological Studies.
KAT^2=Die Keilinschriften und das AT^2 (Schrader), 1883.
KAT^3=Zimmern-Winckler's ed. of the preceding (really a totally distinct work), 1903.
KB or *KIB*=Keilinschriftliche Bibliothek (Schrader), 1889 ff.
KGF=Keilinschriften und die Geschichtsforschung, 1878.
LCBl=Literarisches Centralblatt.
LOPh=Literaturblatt für Oriental. Philologie.
LOT=Introduction to Literature of OT (Driver).
LP=Legend of Perseus (Hartland).
LSSt=Leipziger sem. Studien.
M=Mélusine.
MAIBL=Mémoires de l'Acad. des Inscriptions et Belles-Lettres.
MBAW = Monatsbericht d. Berliner Akad. d. Wissenschaften.
MGH=Monumenta Germaniæ Historica (Pertz).
MGJV=Mittheilungen der Gesellschaft für jüdische Volkskunde.
MGWJ=Monatsschrift für Geschichte und Wissenschaft des Judentums.
MI=Origin and Development of the Moral Ideas (Westermarck).
MNDPV = Mittheilungen u. Nachrichten des deutschen Palästina-Vereins.
MR=Methodist Review.
MVG=Mittheilungen der vorderasiatischen Gesellschaft.
MWJ = Magazin für die Wissenschaft des Judentums.
NBAC=Nuovo Bullettino di Archeologia Cristiana.
NC=Nineteenth Century.
NHWB=Neuhebräisches Wörterbuch.
NINQ=North Indian Notes and Queries.
NKZ=Neue kirchliche Zeitschrift.
NQ=Notes and Queries.
NR=Native Races of the Pacific States (Bancroft).
NTZG=Neutestamentliche Zeitgeschichte.
OED=Oxford English Dictionary.
OLZ=Orientalische Litteraturzeitung.
OS=Onomastica Sacra.
OTJC=Old Testament in the Jewish Church (W. R. Smith).
OTP=Oriental Translation Fund Publications.
PAOS=Proceedings of American Oriental Society.

PASB = Proceedings of the Anthropological Soc. of Bombay.
PB = Polychrome Bible (English).
PBE = Publications of the Bureau of Ethnology.
PC = Primitive Culture (Tylor).
PEFM = Palestine Exploration Fund Quarterly Memoirs.
PEFSt = Palestine Exploration Fund Statement.
PG = Patrologia Græca (Migne).
PJB = Preussische Jahrbücher.
PL = Patrologia Latina (Migne).
PNQ = Punjab Notes and Queries.
PR = Popular Religion and Folklore of N. India (Crooke).
PRE^3 = Prot. Realencyclopädie (Herzog-Hauck).
PRR = Presbyterian and Reformed Review.
PRS = Proceedings of the Royal Society.
PRSE = Proceedings Royal Soc. of Edinburgh.
PSBA = Proceedings of the Society of Biblical Archæology.
PTS = Pāli Text Society.
RA = Revue Archéologique.
RAnth = Revue d'Anthropologie.
RAS = Royal Asiatic Society.
RAssyr = Revue d'Assyriologie.
RB = Revue Biblique.
RBEW = Reports of the Bureau of Ethnology (Washington).
RC = Revue Critique.
RCel = Revue Celtique.
RCh = Revue Chrétienne.
RDM = Revue des Deux Mondes.
RE = Realencyclopädie.
REG = Revue des Études Grecques.
REg = Revue Égyptologique.
REJ = Revue des Études Juives.
REth = Revue d'Ethnographie.
RGG = Die Religion in Geschichte und Gegenwart.
RHLR = Revue d'Histoire et de Littérature religieuses.
RHR = Revue de l'Histoire des Religions.
RMM = Revue du monde musulman.
RN = Revue Numismatique.
RP = Records of the Past.
RPh = Revue Philosophique.
RQ = Römische Quartalschrift.
RS = Revue sémitique d'Épigraphie et d'Hist. ancienne.
RSA = Recueil de la Soc. archéologique.
RSI = Reports of the Smithsonian Institution.
RTAP = Recueil de Travaux rélatifs à l'Archéologie et à la Philologie.
RTP = Revue des traditions populaires.
RThPh = Revue de Théologie et de Philosophie.
RTr = Recueil de Travaux.
RVV = Religionsgeschichtliche Versuche und Vorarbeitungen.
RWB = Realwörterbuch.
SBAW = Sitzungsberichte d. Berliner Akademie d. Wissenschaften.
SBB = Sacred Books of the Buddhists.
SBE = Sacred Books of the East.
SBOT = Sacred Books of the OT (Hebrew).
SDB = Single-vol. Dict. of the Bible (Hastings).
SK = Studien und Kritiken.
SMA = Sitzungsberichte d. Münchener Akademie.
SSGW = Sitzungsberichte d. Kgl. Sächs. Gesellsch. d. Wissenschaften.
SWAW = Sitzungsberichte d. Wiener Akademie d. Wissenschaften.
TAPA = Transactions of American Philological Association.
TASJ = Transactions of the Asiatic Soc. of Japan.
TC = Tribes and Castes.
TES = Transactions of Ethnological Society.
ThLZ = Theologische Litteraturzeitung.
ThT = Theol. Tijdschrift.
TRHS = Transactions of Royal Historical Society.
TRSE = Transactions of Royal Soc. of Edinburgh.
TS = Texts and Studies.
TSBA = Transactions of the Soc. of Biblical Archæology.
TU = Texte und Untersuchungen.
WAI = Western Asiatic Inscriptions.
WZKM = Wiener Zeitschrift f. Kunde des Morgenlandes.
ZA = Zeitschrift für Assyriologie.
ZÄ = Zeitschrift für ägyp. Sprache u. Altertumswissenschaft.
ZATW = Zeitschrift für die alttest. Wissenschaft.
ZCK = Zeitschrift für christliche Kunst.
ZCP = Zeitschrift für celtische Philologie.
ZDA = Zeitschrift für deutsches Altertum.
ZDMG = Zeitschrift der deutschen morgenländischen Gesellschaft.
ZDPV = Zeitschrift des deutschen Palästina-Vereins.
ZE = Zeitschrift für Ethnologie.
ZKF = Zeitschrift für Keilschriftforschung.
ZKG = Zeitschrift für Kirchengeschichte.
ZKT = Zeitschrift für kathol. Theologie.
ZKWL = Zeitschrift für kirchl. Wissenschaft und kirchl. Leben.
ZM = Zeitschrift für die Mythologie.
ZNTW = Zeitschrift für die neutest. Wissenschaft.
ZPhP = Zeitschrift für Philosophie und Pädagogik.
ZTK = Zeitschrift für Theologie und Kirche.
ZVK = Zeitschrift für Volkskunde.
ZVRW = Zeitschrift für vergleichende Rechtswissenschaft.
ZWT = Zeitschrift für wissenschaftliche Theologie.

[A small superior number designates the particular edition of the work referred to, as *KAT*^{2}, *LOT*^{6}, etc.]

although occasionally showing a bold front against the Dominicans in Toulouse. In the East, in their ancient home in Bosnia, on the other hand, they more than held their ground, even compelling the Franciscans to retire from the kingdom (see BOGOMILS); and so recently as 1875 a paragraph in *Le Temps* stated that members of the sect were still to be found in that country. They were also to be met with, long after the Inquisition had done its work, secluded in the valleys of the Pyrenees; but for the last four centuries they have often been confused with the Waldenses, and their independent existence becomes, in consequence, more difficult to trace. In Germany the Catharist becomes lost in the 'Ketzer' [Schmidt, *Hist.* i. 141, ii. 232–233; Lombard (Alex.), *Pauliciens*, etc. (1899), 269–275]. In Albi itself, their final disappearance may, perhaps, be inferred from the fact that in 1404 the bishop of Amboise is to be found giving orders that the bones of St. Amarand should be brought from Vieux (*supra*, p. 277[a]) and deposited in the cathedral church of St. Cecilia, as in a city no longer tainted with heresy (Gregory of Tours, ed. Ruinart, col. 787–788 n.).

LITERATURE. — I. *CONTEMPORARY.* — (i.) Anna Comnena, *Alexias*, lib. iv. ch. 4, xiv. cc. 8 and 9, xv. ch. 8. (ii.) Peter of Vaux-Cernay (Petrus Sarnensis), *De factis et triumphis Simonis comitis de Monteforti* (to Simon's death in 1218), Migne, *PL* ccxiii., Paris, 1855. Peter was the nephew of Guy, the abbot of the monastery of Vaux-Cernay, with whom he went to Provence in 1206; he was the partial admirer of Simon, and is his apologist throughout. (iii.) William de Puylaurens (Guillelmus de Podio Laurentii), *Historia Albigensium* (to the year 1272). William was chaplain to Count Raymond VII., and wrote long after the Crusade. Although not always strictly impartial, he is entitled to the highest credit as an accurate and honest writer. (iv.) *La Chanson de la Croisade contre les Albigeois*, first made known and edited by C. Fauriel (Paris, 1837). This edition is altogether superseded by that of Paul Meyer (2 vols., Paris, 1875–1879); the editor in his Preface (i–cxix) has established the following conclusions: (1) The *Chanson* is the production of two writers, differing considerably in their diction, style, and ideas, the former being one William of Tudela (in Navarre), an ardent partisan of the Crusaders; the latter, who commences line 2768 and carries on the narrative to the siege of Toulouse (June, 1219), was a native of that city, and shows himself throughout a devoted adherent of the party of the seigneurs who opposed the Crusade. Notwithstanding some important omissions, he supplies us with a narrative of the highest value in relation to the subject and of great historical merit. (2) In the course of the 15th cent. the whole poem was reproduced in a prose version (which, like the original, is in a mixture of Provençal and Romanic). This version is generally cited as by *L'Anonyme*, and is printed by Devic and Vaissètte among the *Preuves* (vol. viii. 1–203). It has small literary merit, and, since its claim to be regarded as an original production has been thus refuted, can no longer be regarded as of any historical value. (v.) The Letters, or Registers, of Innocent III. (Migne, *PL* ccxiv.–ccxvii.) are of primary importance. (vi.) The treatise by Eckbert, abbot of Schaunang, in the diocese of Trèves, entitled, *Sermones XIII. adversus pestiferos fœdissimosque Catharorum damnatos errores et hæreses* (Migne, *PL* cxcv. 11), and the Letter of Everwein of Steinfeld to Bernard of Clairvaux, *De hæreticis sui temporis* (Migne, *PL* clxxxii. 676), both written *circ.* 1150, are recognized sources for the doctrinal belief of the Catharists of that period. That of Alanus de Insulis, bishop of Auxerre, *De Fide Catholica contra hæreticos sui temporis* (*ib.* ccx. 305) deals specially with the Albigensian heresy. It appeared towards the close of the century, and was shortly followed by the *Libellus contra Catharos* (*ib.* cciv. 772–792) of Bonacursus, a heretic who had returned to the Church, and who gives, along with the doctrines of the Catharists, the recognized arguments for their refutation. It was owing to a conviction that the arguments advanced by Monéta in his *adversus Catharos et Waldenses Libri V.* (Rome, 1743) were also largely applicable to Lutheran tenets, that the Dominican Ricchini first published this treatise, together with two noteworthy dissertations on the Catharists and Waldenses. The *Summa de Catharis et Leonistis* of Reinerius Sacchoni (*cir.* 1300) is printed in Martène et Durand, *Thesaurus Novus*, vol. v.; and another text, largely interpolated and with a different title, is given by the Jesuit Gretser (*Opera*, XII. ii.).

II. *MANUSCRIPTS.*—Chiefly the collection Doat, now in the Bibliothèque Nationale in Paris, forming 258 vols. in folio; these relate solely to the proceedings of the Inquisition. For critical account of same, see Molinier (Chas.), *L'Inquisition, etc. Étude sur les sources de son Histoire*, Paris, 1881.

III. *MODERN LITERATURE.*—Catel (G. de), *Histoire des Comtes de Toulouse*, Toulouse, 1623; Benoist (Jean), a Dominican, published at Paris in 1691 his *Histoire des Albigeois et des Vaudois*, 2 vols. [a eulogium of persecution, containing, however, important documents]; Limborch (Phil.), *Historia Inquisitionis*, Amsterdam, 1692; D'Achéry, *Spicilegium veterum aliquot Scriptorum*, ed. de la Barre, 3 vols., Paris, 1723; Jas (P.), *de Waldensium secta ab Albigensibus bene distinguenda*, Leyden, 1834; Maitland (S. R.), *Facts and Documents illustrative of the History, Doctrine, and Rites of the ancient Albigenses and Waldenses*, London, 1838; Compayré, *Études historiques et documents inédits sur l'Albigeois*, etc., 1841; Hurter (Fried.), *Gesch. Pabst Innocenz des Dritten*, 4 vols., Hamburg, 1842; Schmidt (C.), *Histoire et doctrine de la Secte des Cathares ou Albigeois*, 2 vols., Paris, 1849; Teulet and de Laborde, *Layettes du Trésor des Chartes*, 3 vols., Paris, 1863–1875; Devic and Vaissètte, *Histoire générale de Languedoc*, 1872–1890, 10 vols., Toulouse, 1873 [this edition refers to the corresponding passages in the edition of 1733–1755, and embodies in the *Preuves* a large amount of new material]; the *Annuaire* for 1879 of *Bull. de la Soc. de l'Hist. de France* (pp. 233–285) contains *Le Débat d'Izarn et de Sicart de Figueiras* with Introd., notes, and tr. by Paul Meyer. The 'disputation' (in Provençal) is between an Inquisitor (Izarn) and a heretic bishop (Sicart), and turns successively on nine of the chief Catharist tenets held heretical by the Church; Hauréau (B.), *Bernard Délicieux et L'Inquisition Albigeoise*, Paris, 1877; Lombard (Alex.), *Pauliciens, Bulgares et Bons-Hommes en Orient et en Occident*, Geneva, 1879; Molinier (Charles), *L'Inquisition dans le Midi de la France au xiii[e] et au xiv[e] siècle*, Paris, 1881; Douais (Mgr.), *Les Albigeois, leurs Origines*[2], etc., Paris, 1880, *L'Albigéisme et les Frères Prêcheurs à Narbonne au xiii[e] siècle*, Paris, 1894, *L'Inquisition: ses Origines, sa Procédure*, Paris, 1906; Lea (H. C.), *History of the Inquisition of the Middle Ages*, 3 vols., London, 1888; Luchaire (Achille), *Innocent III., Rome et Italie*, Paris, 1905; *Innocent. III., la Croisade des Albigeois*, Paris, 1905; Cartellieri (Alex.), *Philipp II. August.* vols. i. and ii., Leipzig, 1906; Guiraud (J.), *Cartulaire de Notre-Dame de Prouille*, 2 vols. Paris, 1907 [the first volume contains an *Étude sur l'Albigéisme Languedocien aux xii[e] & xiii[e] Siècles* by M. Guiraud, grounded chiefly on the MSS Doat, with criticisms on the original sources, and also notes on the following questions:—The distinctive features of the Albigenses and the Waldenses; the latter, the writer points out, sometimes upheld the teaching of the Church in opposition to the former (pp. xxix–xxx); the universal belief of the Catharists that there was no salvation within the pale of the Jewish Church, not excepting even the Patriarchs (xlix–lvii); their estimate of the Catholic Church as absolutely corrupt and incapable of originating either what was morally good or socially salutary (xlix, lx); the *endura*, as a faintly disguised mode of suicide,—although the writer admits that such a charge finds no support in the indictments of the Inquisition (lxiii); he holds, however, that the Catharists, by their rejection of the sacraments of the Church and their denial of the lawfulness of marriage, of oaths, and of capital punishment, undermined the foundations of social life as conceived in the Middle Ages (lxxx–lxxxiv). In the sixth ch. he defines more precisely the limits and activity of the Catharist Churches both in France and in Germany; in the ninth he represents the whole movement as originating in the ancient faiths of the East, through the media of Gnostic and Manichæistic teaching]; *Acta Aragonensia: Quellen zur Kirchen- u. Kulturgeschichte aus der diplomatischen Korrespondenz Jaymes II.* (1291–1327), ed. H. Finke (Berlin, 1907).

J. BASS MULLINGER.

ALCHEMY (Greek and Roman).—At present our knowledge of ancient alchemy is based upon a collection of chemical recipes in a Leyden Papyrus (X, ed. Leemans, *Papyri Musei Lugduno-Bataviensis*, ii., 1885), and a number of manuscripts in several libraries, containing a Byzantine and Mediæval collection of chemical treatises. Chief among these are a Marcianus in Venice, dating from the 10th or 11th cent., and a Parisinus in the Bibliothèque Nationale, written in 1473. The material contained in these manuscripts was edited by Berthelot and Ruelle in the *Collection des Alchimistes Grecs*, Paris, 1888. Unfortunately, this latter edition is without any critical value, not only as regards the constitution of the text, but as regards the writings of the most important among the authors contained in the collection. For, instead of retaining the order, or at least the treatises as they are given in the MS, the editors have attempted an arrangement by ages; and to attain this aim they have cut up the collection, so that it is with the greatest difficulty that one can obtain an idea of the treatises as they were given in the original collection. The difficulty is increased by the fact that even our best manuscript, the Marcianus, is in reality a second edition, with omissions and additions, of an earlier collection, perhaps of the 9th cent., while the younger codices contain much material of very doubtful character. A final judgment must therefore be postponed until some scholar has re-edited the *Corpus Chemicorum* in a manner to conform to modern demands. (On this question compare W. Meyer, *Verzeichnis der Handschriften im preussischen Staate*, i. 1, 5, 1893).

The notices of the ancients themselves in regard to the history of alchemy are scarce. The alleged mentions of the 'science' in the poet Manilius (under Tiberius), iv. 243 ff., and in Pliny's *HN* xxxiii. 79, referring to an attempt of Caligula to make gold, are more than doubtful. The first authentic testimony points to the time of Diocletian. According to Suidas (Διοκλητιανός and Χημεία), the emperor ordered all Egyptian books on the making of gold and silver to be burnt. We are thus taken back to the beginning of the 3rd cent. of our era, a period which teemed with secret, magical, and astrological writings. To the same time points a notice of the Byzantine historian Georgios Synkellos (8–9 cent.), that Julius Africanus mentioned the science of chemistry (676, 10, ed. Bonn). During the 4th cent. the possibility of alchemy was denied by Themistius (*Or.* iv. 214, ed. Petau), and Æneas of Gaza (5th cent.) is undoubtedly well acquainted with its existence. None of these authors, however, uses the modern name. This was formerly believed to be secured by a passage in the astrologer and Christian writer Firmicus Maternus (5th cent.), but the passage is a late interpolation (cf. the edition by Kroll-Skutsch, Leipzig, 1898).

The notice in Suidas points to Egypt as the original home of alchemy. To the same country the legendary history of the pseudo-science also points. The ancient alchemists knew a great many stories about the mystic origin of their art. It was said to have been taught by the fallen angels, by Isis, by Miriam the sister of Moses (the last trace of that legend has been preserved in the 'bain-marie' of modern chemistry), and so forth. But even their best tradition ascribed the invention of the 'holy mystery' to the philosopher Democritus of Greece. This tradition takes us at once to Alexandria, where a luxuriant growth of forgeries under the name of the atomistic philosopher had sprung up, largely ascribed to a certain Bolos of Mendes, living about the beginning of our era. (The literature in Berthelot, *Hist. de l'alchimie grecque*, Paris, 1885; cf. Pauly-Wissowa, i. *s.v.* 'Alchemie'). To Egypt the very name also points (Hoffmann, *Hdwtb. der Chemie*, ii. 516 ff., and Wissowa, *l.c.*).

The extant works on alchemy fall into two classes, roughly represented by the Leyden Papyrus and by the Collection. The former class is purely technical, not yet infected by mystical ideas, and designed for practical purposes. The second class starts likewise from practical work, but from the outset is indissolubly interwoven with mystical thoughts. As time went on without bringing the alchemists any nearer to the solution of the eagerly sought mystery, speculations and fantastic hallucinations overlay the practical nucleus in ever increasing masses, until towards the end of the Middle Ages the writings of the adepts had become one vast farrago of allegories, each one in its turn calling forth a still more allegorical commentary, until the 18th cent. brought about a revolution and a return to practical work, and began the modern science of chemistry.

We shall now rapidly pass in review the extant works. The Leyden Papyrus belongs to a group of papyri found together in Egypt in the early part of the 19th cent. and purchased by the Leyden Museum. Among these, three stand out prominent as a related group. They are known by the letters X (our papyrus), V, and W. The last two have of late come into greater prominence by the excellent treatment to which they have been subjected by Albrecht Dieterich ('Papyrus Magica V' in *Jahrb. f. Philologie*, Suppl. xvi.; *Abraxas, Studien zur Religionsgesch. des späteren Altertums*, 1891). They are our most valuable source for studying the syncretistic religion of later antiquity as reflected in the mind of the vulgar. With these our X must be grouped, as it was found with them. The great mass of its recipes, it is true, contain nothing but prescriptions for the apprentices of some cheating gold- and silver-smith. But these prescriptions are interspersed with others referring to superstition. Small wonder, for the art of the metal-worker from the earliest times was considered to be specially connected with magic; witness the legends of the miraculous creations of Hephæstus, of his Telchines and Daktyloi (see on these Roscher's *Lex. der gr. u. röm. Mythologie, s.v.*), and the northern legends of the smith Wieland. Traces of this belief have lasted into our own times. Even to-day the village blacksmith is usually 'the wise man,' if not actually the wizard, of his village.

Alchemy in the proper sense of the word cannot be said to be found in X. But a large number of its recipes have for their end to produce an alloy of baser metals which cannot be distinguished from the genuine article, so much so that even a member of the guild shall not be able to detect the fraud. But two of its prescriptions use a 'never-ending material' and a special kind of *asemon*. This *asemon*, originally the Egyptian name (*asem*) of an alloy of gold and silver, perhaps the so-called *elektron*, is here conceived as a material which can give the *qualities* of the precious metals to the base ones. It acts, so to speak, as a leaven, changing the base foundation into gold as leaven changes flour into bread; in other words, we are face to face with a real *chemical* action.

At this point the second group of chemical literature sets in. Its most important, nay fundamental, treatise indeed, that of 'Democritus,' bears in its recipes the closest resemblance to the prescriptions of the papyrus (cf. Berthelot's analysis, both in the *Histoire* and in the Introduction to the *Collection*). In close analogy to the papyrus, this treatise also included originally not only the science of commutation of metals, but likewise that of imitating precious stones, and of dyeing cloth. The mystic element, however, is already in full force. Not only is the technical part proper introduced by a fabulous tale, giving the miraculous history of the alleged recovery of the treatise from a secret vault, but it repeats again and again, in the fashion of a refrain, the mystic saying: 'Nature rejoices in nature, nature conquers nature, nature rules over nature'—a saying to which we shall return later on. Other pieces, too, in the *Collection*, according to Berthelot's expert analysis, are more or less closely related to the papyrus, but as some of them do not occur in the oldest MS, we shall leave them undiscussed. One step forward, it is true, has been taken by the author of the pseudo-Democritean work; he is no longer conscious of the fraudulent character of his practices, but honestly believes in the possibility of transmutation.

We have called the above work fundamental. And so, indeed, it must be called, in view of the fact that after its existence nothing new was written, and that all successors either had no higher ambition than to comment upon it, or started from it as their basis. Here belong the works of Synesius (not the Cyrenæan bishop of this name, although a contemporary of his), of Olympiodorus (of doubtful age, but perhaps living under Justinian), and of Zosimus (the most important of them all, though the most elusive). The question of the latter's personality, as well as of his time, is so perplexing because for his writings more than for anything else the editorial method of the French Collection has been confusing. In the several hundred quarto pages filled by pieces ascribed to him, many parallel and even contradictory pieces from old as well as from new codices are jumbled together. This much is sure, however, and borne out by the Index of the Marcianus, that of all the commentators he was the most important. Certain indications in his writings allow us to conjecture that he lived after the philosopher Porphyrius, and before Olympiodorus. He also seems to allude to Mani, the founder of Manichæism. We shall therefore not err very much one way or the other, if we assign him to the early years of the 4th cent. of our era. Suidas (*s.v.*) tells us that he came from Panopolis in Egypt, and lived in Alexandria.

The later Greek alchemists can find only a passing mention in this article. Such are Stephanos, contemporary of the emperor Heraclianus, and the alchemistic poets, four in number, who in Byzantine trimeters revamp the scanty ideas of Stephanos. Numerous smaller treatises, preserved in MSS, cannot even be mentioned here. The question of their value is indissolubly bound up with that of the value of our tradition.

We shall now be able to trace in a very few words the development of alchemy. Starting from the purely practical basis of fraudulent craftsmanship, in Egypt, famed from olden times for her knowledge of metalwork and crude chemical knowledge (cf. the Egyptian porcelains and glasses), it found its further development in that home of all mystic humbug, Alexandria. Here it fell under the influence of that mixture of religions, of mysticism, and of philosophy which we call either Syncretism or Gnosis, and pursuing that kind of knowledge found its 'Bible' in the forged treatise ascribed to Democritus. Also in the manner of that kind of literature, counter-claim met claim; hence the various traditions as to the real inventors of alchemy. Conforming partly in ideas and in expressions to Christianity, it escaped the fate of other superstitions,—the condemnation of the Church,—was carried to Constantinople, and there vegetated in peace in the dust of libraries. On the other hand, through Syrian translations it found its way to the Muslims, was by them carried to the West, and so reached Europe, where it was received with credulous avidity, and flourished until superseded by truly scientific methods, thus finally flowing into the broad stream of true and modern chemistry.

It remains now to speak of the relations between alchemy and philosophy and religion. The researches of Usener (*Religionsgeschichtl. Untersuchungen*, Bonn, 1889–1897), of Dieterich (*l.c.*), and of Schmekel (*Untersuchungen zur Geschichte der Mittlern Stoa*) have shown how enormous was the influence of the Stoic school on the development of popular beliefs in the last cent. B.C. and the 1st cent. A.D. In regard to alchemy, however, the proof had been furnished as early as 1856 by Prantl (*Deutsche Vierteljahrsschrift*, 1856) in an article which still contains the best exposition of the philosophical elements in ancient alchemy. The Stoics, in their endeavour to prove that the whole cosmos was permeated by the Divine, and that all phenomena of life were only emanations of it, could not afford to reject any claim to the supernatural raised by these pseudo-sciences, and so they became the ardent defenders of magic, alchemy, and astrology (for the latter see Bouché-Leclercq, *Hist. de l'Astrologie grecque*). *Vice versa* these sciences gratefully adopted the apparent aid to be got from the Stoic arsenal of proofs. When the Democritean theory constantly harps on the refrain : 'Nature overcomes nature, nature rejoices in nature, nature rules over nature,' the alchemists simply followed Stoic precedent. Nay, this very tenet is considerably older than the extant works on gold-making. It is ascribed to the mythical Egyptian king Nechepsos, the patron saint of astrology, whose forged works found their entrance into the world of letters about the beginning of our era. The maxim, too, upon which the Leyden Papyrus bases its prescriptions, that a little leaven leavens a whole loaf, belongs here. When later, in the 2nd and 3rd cents. of our era, that jumble of all philosophies, from the Ionians to Neo-Platonism, which we call Hermetic philosophy, gained ascendency, it too was eagerly adopted by the alchemists. Hermes now becomes the great protagonist and inventor of the science. Nor were the alchemists averse to borrowing from other pseudo-sciences. They were deeply indebted to Astrology, again under the influence of Stoic ideas. Not only do some treatises take account of favourable planetary aspects, but the theory that the planets exercise a profound sympathetic influence over the component parts of the universe found its expression in the small but significant fact that the metals are written in the manuscripts by a sort of planetary notation: for gold they wrote the sign of the sun, for silver that of the moon, and for quicksilver that of Hermes, whence the English name 'mercury.' No less strong is the influence of that syncretism which we are accustomed to call Gnosis. The greatest of all commentators, Zosimus, explains the title of his last chapter, *Omega*, by telling us that it belongs to the sphere of Kronos, but only *κατὰ ἔνσωμον φράσιν*, while the *ἀσώματος φράσις* is known only to the great and hidden Nikotheos. Not only the name itself is Gnostic, but still more so the distinctions between a corporeal and an incorporeal expression; for this distinction between Jesus in the body and without a visible body forms the very foundation of Gnostic speculations.

This leads us into the sphere of religion. Now we must not expect to find in the alchemists any new information about the religious speculations of their time. These men, locked up as they were in their narrow laboratories, were simply receptive, and only reflected what was saturating the air around them. In this sense only may we go to the alchemists as a source of religious information. And here we find what we should expect. All religions have been jumbled into a great chaotic mass. Everything is 'One and All.' But nevertheless, individual deities, like Hermes, Kronos, Aphrodite, play their part. Nor were the alchemists averse to calling in the help of Judaism, and of Christianity as it appeared to them. Zosimus embodied in his commentary a piece containing highly interesting speculations about Adam. But, on the whole, we may repeat what Usener says about the speculations of the Gnosis: like a sultry breath of air carrying to us wondrous scents from an unapproachable garden, such is the impression of the Gnostic (and alchemistic) teachings.

LITERATURE.—Kopp, *Beiträge zur Gesch. der Chemie*, 1869; Leemans, *Papyri Græci Musei Lugduno-Batavensis*, ii. 1885; Dieterich, 'Papyrus Magica V,' *Jahrb. f. Philologie*, Suppl. xvi., and *Abraxas*, 1891; Berthelot, *Origines de l'Alchimie*, 1885, *Journal des Savants*, 1884, 1893; Berthelot and Ruelle, *Les Alchimistes Grecs*, 1888 (partly reprinted, with independent pagination, in Berthelot, *La Chimie au moyen âge*); Hoffmann in Ladenburg, *Hdwtb. der Chemie*, ii. under 'Chemie'; Tannery, *Revue des Études Grecques*, iii.; Jahn, *Revue de Philologie*, xv.; Bouché-Leclercq, *Hist. de l'Astrologie Grecque*; Schaefer, *Die Alchemie*, 1887; Pauly-Wissowa, i. *s.v.* 'Alchemie.'

E. RIESS.

ALCHEMY (Muhammadan). — I. **Authors.** — The most ancient Arabic author who wrote about alchemy was a royal personage — Ḫālid, son of Yazīd, son of Mu'āwīya—who died A.H. 85 (A.D. 704). There are three letters on alchemy ascribed to him; his master is said to have been a Syrian monk, Morienus or Marianus, and to have dedicated a treatise on alchemy to him: *Liber de compositione Alchemiæ, quem edidit Morienus Romanus Calid regi Ægyptorum*, tr. in 1182 by Robert Castrensis (cf. Leclerc, i. 64). Compositions ascribed to Ḫālid and translated into Latin are published in the *Theatrum Chemicum* and in the *Bibliotheca Chemica*; the Arabic text of these is not extant.

The historian Ibn Ḫaldūn, in his *Prolegomena* (iii. 207 in de Slane's Fr. translation), questioned the authenticity of the alchemical works of Ḫālid the Umayyad, on the ground that this prince was a Bedawī Arab who lived before the time of the scientific activity of the Arabs, and that therefore he could not have been acquainted with such a complicated science as alchemy. However, the tradition is very exact, both in the *Book of Songs* (*Kitāb al-Aghāni*, xvi. 88–98), and in Mas'ūdi (*Les Prairies d'or*, ed. and tr. into Fr. by Barbier de Meynard, viii. 176). This historian says that alchemists acknowledge Ḫālid, son of Yazīd the Umayyad, as one of their elder brothers.

The second name to be mentioned is that of Geber. This famous person, who became illustrious and legendary in the Christian Middle Ages, is known under the Arab name of Abū Mūsā Jābir, son of Ḥaiyān; his tribal name is 'the Azdite'; from the place of his birth he is named 'of Ṭūs' or 'of Ṭarṭūs'; he is sometimes called al-Ḥarrānī, which agrees with the tradition connecting him with the Sabæans of Ḥarrān. The surname 'al-Umawī, the Umayyad,' which is sometimes given him, represents a tradition according to which he had Ḫālid, son of Yazīd, as master; but other accounts describe him as a pupil of Ja'far aṣ-Ṣādiq, who is also credited with a profound knowledge of occult sciences, and to whom bibliographers ascribe works on science and divination (cf. Hajjī Ḫalfa, v. 277, 280; Ibn Ḫallihān, No. 130). Lastly, there is occasionally coupled with the name of Geber the epithet 'Ṣūfī'; this is explained by the fact that Geber, having been converted from Sabæism to Islām, is said to have exhibited great zeal for the Musalmān faith; the title must have been added, however, at a later period.

We should clearly pay no heed to a view mentioned in the *Fihrist* (p. 354 ff.), according to which

Geber is a mythical personage. This famous alchemist did certainly exist; but very little is known about his life. A reliable tradition represents him as usually residing at Kūfa; he is sometimes connected with the Barmecides (*Fihrist* and Hajjī Ḫalfa, iii. p. 588). He flourished about the year A.H. 160 (A.D. 776). A whole series of works is attributed to him; their titles are generally symbolical, and their number exceeds two hundred. There are twenty-two Arabic works placed under his name in our libraries. Berthelot and Houdas have published five of these treatises under the titles of: *Book of Royalty; Small Book of Balances; Book of Mercy*, a work revised by a pupil; extracts from the *Book of Concentration;* and *Book of Oriental Mercury*. The Latin treatises ascribed to Geber do not correspond to the Arabic works; besides, they exhibit a more advanced stage of chemical science. Some of these are: *Geberi regis Arabum summa perfectionis ministerii,* Gedani (Dantzig), 1682; *Geberi philosophi de alchemia libri iii.*, Nuremberg, 1545 (cf. Steinschneider, *ZDMG* xiii. 649). The Latin treatise, entitled *Book of the Seventy* of Jo (John), is the only one which seems to have preserved some fragments of Geber or his pupils, judging from the resemblance between the titles of its chapters and those of a work of the same name which the *Fihrist* mentions and ascribes to Geber (Latin MS 7156, Paris; cf. Berthelot, *La Chimie au moyen âge*, i. 323).

There were several alchemists in the 3rd cent. A.H.; the two most famous are the ascetic Dhū-n-Nūn al-Miṣrī of Ikhmīm (d. 245=A.D. 859) and Ibn al-Waḥshīya, the imaginative author of the *Nabatæan Agriculture*, who wrote during the second half of that century. We possess three works of Dhū-n-Nūn on alchemy—in poetry, dialogue, and miscellany (cf. R. A. Nicholson in *JRAS*, 1906, p. 311 ff.). We have various works of Ibn al-Waḥshīya, especially a *Treasury of Wisdom* or *Secrets* (*Kanz al-ḥikma* or *Kanz al-asrār*), which is a system of alchemy. We may add to these names that of Muḥammad, son of Umail (rather than Amyal) at-Tamīmī, who composed, among other things, an essay on ancient Egyptian paintings; and that of Uthmān, son of Suwaid al-Ikhmīmi, who disputed with Ibn al-Waḥshīya.

In the 4th cent. (10th A.D.) appears the medical philosopher 'Razes,' Abū Bakr Muḥammad, son of Zakarīya ar-Rāzī. He was an enthusiastic student of alchemy, and almost a martyr to this science. As he had dedicated his famous book on medicine, *al-Manṣūri*, to the Sāmānid prince Abū Ṣāliḥ Manṣūr, son of Isḥāḳ, he afterwards also presented him with his plea, 'The Establishment of Alchemy' (*Kitāb ithbāt al-kīmīya*). The prince asked him to verify some of his experiments, and, finding him unable to do so, he struck him across the face with a whip, and blinded him. He died in A.H. 311 or 320. We may mention his *Kitāb al-asrār*, 'Book of Secrets,' on alchemy; a *Preparatio Salis Aromatici*, placed under his name, is published in the *Theatrum Chemicum*, iii. No. 64.

To the same century belongs another important writer, Maslama al-Majrīṭī, *i.e.* of Madrid. This learned encyclopædist (d. 395 or 398=A.D. 1004 or 1007), after travelling in the East, brought thence to his native country a collection of the famous works of the 'Brethren of Purity,' of which he probably made a new recension. Being skilled in alchemy, he wrote specially on this subject a *Kanz al-faḍā'il*, 'Treasury of Accomplishments,' dated 348.

We may mention in passing another prince, who was reputed to be an alchemist, the celebrated Fāṭimid Ḫalīfa al-Manṣūr al-Ḫākim (d. 411=A.D. 1020), the founder of the religion of the Druzes. The only famous names that we find after him are those of Ghazzālī the great philosopher, Ṭughrā'ī, and Jildakī. Ghazzālī (451–505=A.D. 1111) believed in alchemy, and wrote some articles on the subject; one of them is extant at Berlin, *Maqāla al-fauz*, 'Lecture on Preservation.' Ṭughrā'ī (al-Ḫasān, son of 'Alī), who died about 515, wazīr of the Seleucid Sultan Mas'ūd at Mosul, became famous as an alchemist, wrote on alchemy, *Jāmi' al-asrār*, 'Compendium of Secrets,' an article on the philosopher's stone, and a commentary on Geber's *Book of Mercy*. Jildakī ('Ali, son of Aidamur, son of 'Alī), who died in 743=A.D. 1342), is the author of several works on alchemy and the search for 'the elixir' (cf. on this author S. de Sacy, *Notices et extraits*, iv. 108; Leclerc, ii. 280).

Alchemical studies continued in Islām during the time of the literary decline and down to the present day. In the 10th cent. A.H. (16th A.D.) authors like Muṣliḥ ad-Dīn Bostān Efendi of Aidīn, or 'Alī Beg of Iznīq, are found writing 'Alchemies,' and in the 11th cent. the physician Maulā Ṣāliḥ, son of Naṣrallāh al-Ḫalabī, adapted Paracelsus. It is said that there are still alchemists in Morocco and at Mecca.

2. Doctrine.—The doctrine of alchemy appears among the Arabs under very philosophical aspects; it implies certain ideas on the nature of physical matter which are derived from general philosophy. This connexion with philosophy is so very close, that we come upon treatises beginning with real philosophical introductions; *e.g.* the 'Treatise on Concentration' goes so far as to speak expressly of the doctrine of the 'categories,' which it ascribes to Pythagoras, saying that there are ten things which form the universe: essence and its nine accidents.

It is not difficult to see with what philosophical school the alchemists are, as a rule, connected. It is with the great school of Neo-Platonic origin, which developed in the Musalmān world when the Greek sciences were being studied there, and attained its height about the 10th cent. of the Christian era (4th A.H.). The alchemists are connected more especially with the branches of this school which professed the so-called 'illuminative' doctrines. In these sects a disposition to syncretism prevailed: according to them, truth was possessed in the different nations by wise men who expressed it in different ways, and who are at one time mythical personages, at another well-known philosophers of very different opinions. The same inclination towards syncretism is shown in the alchemical writings. The alchemistic authors do not know whether they owe their art to Egypt rather than Persia, or to India rather than China. The ancestors whom they claim are at one time quite mythical, *e.g.* Hermes and Agathodæmon; at another historical or semi-historical, *e.g.* Qārūn, the Korah of the Bible, brother-in-law of Moses, whose treasures are mentioned in the Qur'ān (xxviii. 76, 79, xxix. 38, xl. 25); or, again, queen Cleopatra, the emperor Heraclius, or Bilqīs, the queen of Sheba. To these soothsayers and kings the alchemists add the philosophers and scholars of classical antiquity, especially Pythagoras, Plato, Aristotle, Democritus, Dioscorides, and Galen. This grouping would not give any very clear information, if we did not know from the history of philosophy that the list is framed according to the usage of the Alexandrians and the Sabæans, and that therefore it was in these two groups of scholars that the Muslims found their masters. As regards the Sabæans, we have already remarked that Geber probably belonged to their sect; they carried the practice of syncretism to a great length; they collected and fixed a large number of legends of various origins. The addition of the Talmudic legends of Qārūn and of Bilqīs, of the Persian names of Jāmāsp and of

Maghis the sage, to the Egyptian legends of Hermes and Agathodæmon, must have been their work. More especially Alexandrian are the legends, of frequent occurrence in the alchemical writings, which refer to the Pyramids and the great ruins of Egypt, and represent these monuments as ancient laboratories, or at least as having been used as deposits for the secrets of the sciences. The tradition which makes Cleopatra a scientist is undoubtedly Alexandrian, as is also the one which represents another woman, Mary the Copt, as lecturing on alchemy in the presence of various learned men (cf. Kopp, *Beiträge*, i. p. 402; Steinschneider, *Mathem.* § 140; Berthelot, *La Chimie au moyen âge*, iii. *passim*). One of the Arabic treatises published by Berthelot and Houdas bears the name of an Egyptian sage Ostanes.

Another tendency which appears from time to time in the alchemical writings certainly arises from Neo-Platonism, viz. the tendency to mysticism. It makes itself evident in two ways: (1) by founding the art of alchemy on a revelation which was received by the ancient prophets, *e.g.* by Hermes or by Qārūn; or (2) by making moral conditions intervene in the production of the great work: God co-operates in the undertaking, and the alchemist must prepare himself for this Divine co-operation by purity of heart. Even in the cases in which this condition is not formally laid down, the alchemistic writings bear a strongly religious stamp.

It is a very wide-spread custom among writers on occult subjects to connect the metals with the planets. Gold is held to correspond with the sun, silver with the moon; the other metals, mercury, iron, tin, lead, correspond respectively to Mercury, Mars, Jupiter, and Saturn. This connexion was made long ago, but the Muslims ascribe it more especially to the Sabæans; and this provides a new proof of the important part which that sect took in the transmission of ancient ideas, Greek as well as Jewish and Chaldæan.

The part played by Syrian scholars in this work of preserving and handing down scientific knowledge was greater even than that of the Sabæans; and it is better known. It was through Syrian works that the Muslims became acquainted with the chief Greek alchemists, especially Zosimus (cf. Berthelot, *La Chimie au moyen âge*, ii.).

Now, what exactly is the doctrine, or rather the postulate, on which alchemy is based? This postulate, in its essential elements, is very simple. It holds that metals differ from each other in degree, but not in nature, and that any one of the baser metals, like lead or copper, may be transmuted into a more perfect metal like silver or gold. This postulate is connected with or implies a curious idea frequently expressed by alchemists, that of the 'life' of the mineral. The metal or the mineral is really regarded as a living being, which is engendered and develops in the womb of the earth, where it is subjected to various conditions, such as help or hinder its perfection. This theory is expressed, *e.g.*, in the treatise of the 'Brethren of Purity' devoted to mineralogy. Dieterici, the editor of that treatise, remarks that it is conceived on Aristotelian, one might say rather, Neo-Platonic principles, and that it is inserted in a series of treatises based on those of Aristotle, although we do not know any work on minerals by that philosopher.

In that treatise the doctrine is presented thus. From the elements which lie like potentialities in the womb of the earth, there are first of all formed, as energies, mercury and sulphur; from those two there are afterwards formed, as entelechies, metals which are good or bad, noble or base, according to circumstances. It is only in consequence of certain injuries undergone that the material does not become silver or gold instead of lead or tin. Alchemy endeavours to repair these injuries (Dieterici, *Die Abhandlungen der Ikhwān es-Safā*, Leipzig, 1886, Vorwort, p. 18, and text, p. 137). The same idea is expressed in the *Cosmography* of Qazwīnī (ed. Wüstenfeld, i. p. 207), and in this work also it is ascribed to Aristotle; the metals in their mines undergo certain injuries which cause their imperfections: *e.g.* lead is a kind of silver which has three defects—an unpleasant odour, softness, and a disagreeable sound. In this book also, means of getting rid of these defects are suggested.

In the works of Geber published by Berthelot, and especially in the *Book of Mercy*, whose authenticity appears most certain, this notion of the life of metals is consistently expounded; a regular anthropomorphic theory is applied to mineralogy; not only the idea of 'generation' applies to metal, but also the ideas of 'marriage, pregnancy, and education'; all these conditions, it is said, are necessarily the same as in the case of a human being. This doctrine is expressed with equal force in the treatise by al-Ḥabīb, published in the same collection and apparently quite ancient. According to these various alchemists, the formation and the life of metals require time, like our own; to bring the metal in the womb of the earth to its perfect state, which is the state of gold, nature takes a very long time, more than a thousand years, according to the most wide-spread alchemistic tradition; the work of alchemy is to imitate nature, and at the same time to discover more rapid means than hers for the development of the metal.

The anthropomorphic theory of alchemists has one more aspect; it applies to chemical bodies the ideas of life and death, of body and soul, of matter and mind. In this sense the idea of occult forces is very interesting; these subtle, intangible, invisible forces are compared to 'spiritual forces'; the force of the magnet, which attracts iron through other materials, and that of poison, which permeates the organism, are called 'spiritual forces' (Berthelot, *Geber: 'Traité de la miséricorde,'* p. 175). In bodies there are some substances earthly and gross, and others pure and light; the former are called 'dead,' the latter 'living'; these notions of death and life are also employed in a relative way: *e.g.* sulphur and arsenic are living when they are mixed with substances inferior to them, such as talc; but they appear earthly and dead when they are united with live mercury (*ib.* p. 178). In every body, and *a fortiori* in every combination, it may be supposed that there is a material part and a spiritual part, a soul and a body. The soul is infused into the body; its nature is superior to that of the body, refines it, and gives it a kind of immateriality. A common task for chemists consists in giving a soul to each body, by first purifying souls and bodies, and then infusing into each body the soul which suits it. Geber, still following the idea that there were certain injuries caused by nature, even speaks of 'restoring' to the body the soul which 'has gone out of it'; this is another aspect of a chemical operation; thus, mercury is the soul which suits gold and the other metals. The spirit also is capable of a sort of education; not only must it be fit to unite forcibly with its body, and for that reason be pure, but it must also be firm, it must resist fire, and to this end must, as far as possible, partake of the nature of fire.

In practice, the aim of the alchemist's efforts is to find the substance, a living substance, 'elixir' or spirit, which, when combined with the body of the imperfect metal, previously prepared and purified, will change it into perfect metal. Alchemists use various means, and look in various places to find this substance; they do not regard it as exclusively mineral; they even make use of organic bodies in its preparation; they discuss whether it is 'excrement, blood, hair, or egg'; as a rule, they describe it as a stone; it is 'the Philosopher's stone, the very precious stone.' This stone is afterwards ground down, and during the grinding it is sprinkled with water mixed with drugs and simples. The liquid obtained in this way is the 'elixir.'

3. Discussions of the doctrine.—During the course of Arabic literary history, various persons assumed an attitude of opposition to the alchemical doctrine. This opposition led to discussions. It must, however, be stated that the objections raised were not directed against the study of bodies and their properties, but only against the assumption peculiar to alchemists, concerning the possibility of the transmutation of metals. In the 3rd cent. A.H. the philosopher al-Kindī declared himself against the alchemists. He wrote a treatise on 'the error of those who think that gold and silver can be obtained otherwise than in their mines,' and another on 'the deceits of alchemists.' A pupil of al-Kindī, Dubais, took up the cause of the alchemists, however, and wrote two treatises on their science, cited in the *Fihrist*. Razes composed a 'refutation' of the objections of al-Kindī. Fārābī believed in alchemy, but Avicenna (Ibn Sīnā), was opposed to it (see AVICENNA). Ṭughrā'ī afterwards defended alchemy against Avicenna.

Avicenna's chief objection consisted in saying that the seven metals differ in their specific qualities, each of them forming a definite species with real characteristics; Fārābī believed, on the contrary, like the alchemists, that all metals were of the same species, and he considered their qualities merely as accidents. Ṭughrā'ī, bringing in the Divine power, observes, in addition, that it is not a question of producing a specific difference in the metal treated, but of making it fit to receive this difference from its Creator. Avicenna also objects, like al-Kindī, that it is incredible that there can be a shorter way of bringing metals to their perfect state than that which is followed by nature.

The other objections brought forward against alchemy are: that no one has ever been pointed out with certainty as having achieved the great work; that it is especially poor people who study alchemy; that alchemists circulate counterfeit gold, and in that way wrong the public, and are liable to punishment by law. This latter accusation refers to the cases in which alchemists succeeded in giving to metal what they called a dye, *i.e.* in covering it with a layer which had the appearance and some of the properties of gold. The alchemists replied, weakly enough, it is true, to these objections, by saying that this 'dye' was fast, and would last several centuries.

The cosmographer Dimishqī (ed. Fraehn, p. 97) and the historian Ibn Ḥaldūn (*Prolegomena*, de Slane's Fr. tr. iii. 207 ff.), opponents of alchemy, speak in an interesting way about alchemists, and relate the objections which were raised against them.

4. Special contribution of Muslims to alchemy.—It is very difficult to determine exactly the share due to Muslims in the progress of chemical discoveries. It was, apparently, very slender. The most ancient Arabic works are adaptations of, or commentaries on, Greek works; that of Crates is typical. The discoveries which Western tradition has ascribed to Geber, those of *aqua regalis*, of sulphuric acid, nitric acid, and nitrate of silver, are not found in the Arabic works placed under this alchemist's name, but only in some Latin pamphlets at the end of the 13th cent.; it seems, therefore, that the admiration affected by the Western peoples for Muslim alchemists is due not so much to their real worth, as to the general custom of looking to the East for masters, especially of the occult sciences.

It is probable, however, that Muslims made progress in chemistry as applied to medicine, in dyeing, and in the art of enamelling. Al-Kindī, besides others, wrote about colouring matters, glass-making, the processes of removing stains from cloth, and other similar subjects. These particular industries have not yet been studied minutely enough.

Every one knows that our languages are indebted to Arabic chemistry for certain words, which are in some cases Arabic words, in others Greek words preceded by the Arabic article; *e.g. alchemy, alembic, aludel, alcohol, elixir*. The word *alchemy* has been derived from χυμεία, 'mixture.' Wiedemann has shown that this word originally denoted the very substance which has the property of accomplishing transmutation, the elixir, and not the sum of the ways which help to find it (Wiedemann, *Beiträge*, ii. p. 351; J. Gildemeister, *ZDMG*, 1876). The *koḥl*, which has given its name to alcohol, was originally a very fine powder; it is the black powder which Oriental ladies use for blackening round their eyes. The use of the word was generalized and extended to various powders and to liquids. *Elixir* is said to be derived from Greek ξήριον, 'dry powder' (J. Gildemeister, *l.c.*); it is possible, however, from the point of view of the grammatical form, that it is an Arabic word and belongs to the root *kasara*, 'to grind,' *al-iksīr* being 'the thing ground,' 'the powder.'

LITERATURE.—Berthelot, *La Chimie au moyen âge*, 1885, pt. i., *Essai sur la transmission de la science antique au moyen âge*, Paris, 1893, pt. iii. with the collaboration of O. Houdas, *L'Alchimie arabe*, 1893; Eilhard Wiedemann, *Beiträge zur Gesch. der Naturwissenschaften*, i.–iv., Erlangen, 1904–1905. On the Arabic authors see Brockelmann, *Gesch. der arab. Litteratur*, 2 vols., Weimar and Berlin, 1897–1902. Latin works on alchemy given as translations from Arabic are found in the following collections: *Theatrum Chemicum*, 6 vols., Strassburg, 1659–61; *Bibliotheca Chemica*, Geneva, 1702; *Artis auriferæ quam chemiam vocant duo vol.*, Bâle, 1572; *Artis chemicæ principes*, Bâle, 1572. A famous work. entitled *Turba philosophorum*, is found in two different versions in the collection *Artis auriferæ*; an 'Alchemy' ascribed to Avicenna, *Liber Abuali Abincinæ de anima in arte Alchimiæ*, is found in the *Artis chemicæ principes*. On several of these works and on mineralogy, cf. F. de Mély, *Les Lapidaires de l'antiquité et du moyen âge*, pt. iii. No. 1, Introduction, Paris, 1902.

BON. CARRA DE VAUX.

ALCHEMY (European).—The study of alchemy in Europe is traceable to the schools of Spain. J. Ferguson, in his notes to the 'Catalogue of the Alchemical, Chemical, and Pharmaceutical books of James Young of Kelly and Durris,' notes which form the latest storehouse of information on the history of alchemy in Europe, says, under the head of Michael Scott: 'It was in Spain, to which it had been brought by the Arabs, that the art first found place in Europe' (*Bibliotheca Chemica*, Glasgow, 1906).

The Khalīfate of Cordova reached its highest splendour under the rule of Abderrahman III. (A.D. 912–961) and Al-Ḥakam II. (961–976). The libraries of the rulers, the nobles, and persons of importance, numbering in some cases 400,000 volumes, attracted students from all parts of Europe (Rafael Altamira of Crevea, *Historia de España*, i. 275).

1. Among the first to profit by this revival of learning was Gerbert, afterwards Pope Sylvester II. (999–1003). While still a student in the Abbey of Arvillac in Auvergne, he attracted the attention of Borel, Count of Barcelona. He returned with him to Spain, and is said to have visited Cordova during the reign of Al-Ḥakam II. It was in the schools of Spain that he studied the sciences of arithmetic, geometry, astrology, and chemistry, which at a later date brought him into disrepute as a wizard. During the Papacy of John XIII. (965–973) he visited Rome in the company of Count Borel and Hatto, Bishop of Vich. He then made the acquaintance of the Emperor Otho I., and was recommended by him to the notice of Adalbero, Archbishop of Rheims. By Otho II. (973–983) he was

appointed Abbot of Bobbio. Driven from Bobbio by the neighbouring nobles, he returned to Rheims, where he taught the 'whole range of human science.' On the degradation of Arnulf, he was made Archbishop of Rheims in 991. Forced to resign the see in 996, he took refuge at the Court of Otho III. (983–1002), and by his influence in 998 he became Archbishop of Ravenna. In the following year he succeeded to the Papacy. Thus by the close of the 10th cent. the learning of Spain was introduced into France and Italy and the Imperial Court (Milman, *Lat. Chr.* iii. pp. 331–345).

2. The influence of Gerbert did not end with his death. His pupil, Fulbert of Chartres (1007–1028), carried on his work. Adelmannus, Bishop of Brescia, in a letter to Berengarius, speaks of their joint studies 'in Academia Carnotensi, sub nostro illo venerabili Socrate, nempe Fulberto' (Bar. *Ann. Eccl.* 1004, 6). The Schools of Berengarius in Tours and Angers to some extent carried on the same work. Behind the theological controversy of the early Scholasticism of the 11th cent., the tradition of the wide learning of Gerbert may be traced as one cause of the recognition of the philosophical studies of Spain in the 12th cent. (Neander, *Gesch. der Chr. Rel. u. Kirche*, iv. 283).

3. The fall of the Khalīfate of Cordova in 1031 did not check the progress of learning in Spain. The kings of Seville, Cordova, Malaga, Granada, Almeria, Denia, Zaragoza, Toledo, and Badajos vied with one another in the patronage they gave to philosophy and science. The studies of the former period were continued, and special attention was given to the natural sciences—medicine, chemistry, botany, and astronomy. Ibn al-Baiṭar of Malaga made a large collection of minerals and plants, and under the Muwaḥḥid Khalīf Ya'qūb al-Manṣūr (1196) the Giralda of Seville became the chief observatory in Europe. In philosophy, Averroës of Cordova (1126–1198) won a European reputation as the commentator of Aristotle and Plato.

4. The conquest of Toledo by Alfonso VI. of Castile in 1085 was another step in the propagation of the Arabic learning in Europe. A school of translators was founded at Toledo which reached the highest point of its fame in the reign of Alfonso VII. (1130–1150). Among those who were attracted to Spain were Hermann of Dalmatia and Hermann of Germany, Gerard of Cremona, the Englishmen Daniel of Morlay, Robert the Archdeacon, and Michael Scott (Raf. Altamira Crevea, *op. cit.* i. 484–514). It was in 1182 that Robert Castrensis translated the *Liber de compositione Alchemiæ*, associated with the names of Ḥālid and Morienus. To the same period belongs the teaching of Alain de Lille, known as 'Doctor universalis,' who had been a monk at Clairvaux, and was afterwards Bishop of Auxerre.

5. **Michael Scott** was among the first to bring alchemy into prominence in Europe under the patronage of Frederick II. (1194–1250). He dedicated his *de Secretis* to Frederick in 1209. He studied Arabic in Sicily, and spent ten years in Spain. At Toledo he translated Aristotle's treatise on Natural History from the Arabic, with the help of a Jew. In 1217 he translated an Arabic work on the sphere. This is a link with the studies of Gerbert, who in a letter to Remigius, a monk of Trèves, excuses himself for not sending a sphere, owing to his time being occupied with civil business.

> 'Sphæram tibi nullam misimus, nec ad præsens ullam habemus, nec est res parvi laboris tam occupatis in civilibus causis. Si ergo te cura tantarum detinet rerum, volumen Achilleidos Statii diligenter compositum nobis dirige, ut Sphæram, quam gratis propter difficultatem sui non poteritis habere, tuo munere valeas extorquere' (Gerberti *Ep.* 134, *ap.* Duchesne, *Hist. Franc. Script.* ii. 820).

From Toledo he went to Cordova; in 1220 he returned to Sicily, and in 1230 he was at Oxford. He died in 1235. Ferguson says of him:

> 'At Toledo he learnt magic for which the city was famous—natural magic or experimental physics or jugglery, as well as black magic, involving the invocation of the infernal powers. There, too, he experimented in Alchemy' (*Bibl. Chem.*, art. 'Michael Scott').

His *Liber de Alchimia* is the result of these studies.

6. **Albert the Great** has the merit of having brought the study of alchemy as a branch of philosophy into touch with the Scholasticism of the Middle Ages. The Great Chronicle of Belgium in 1480 speaks of him as 'magnus in magia, major in philosophia, maximus in theologia.' Born at Lauingen in Swabia, he studied at Paris and Padua, and in the early part of the 13th cent. taught in the Schools at Cologne. In 1228 he was called to Paris, but after three years returned to Cologne. He was the most distinguished amongst the Dominicans of Germany. In 1260 he was summoned to Rome by Pope Alexander IV., and was made Bishop of Ratisbon. He resigned the see after three years, and retired again to his studies and his lectures at Cologne, where he died in 1280. He was the master of Thomas Aquinas (Milman, *Lat. Chr.* ix. 122). His *Libellus de Alchimia* (Alb. Magn. *opp. omn.*, Paris, vol. xxxvii.) is a practical treatise on the transmutation of metals, the structure of furnaces, and the various methods to be used in the study of alchemy. The Preface is valuable as indicating the wide-spread interest which was then shown by all classes in the study:

> 'Inveni multos prædivites litteratos, Abbates, Præpositos, Canonicos, Physicos, et illiteratos, qui pro eadem arte magnas fecerunt expensas atque labores, et tandem deficiebant quoniam artem investigare non valebant.'

He persevered where others had failed:

> 'Ego vero non desperavi, quin facerem labores et expensas infinitas' (*Lib. de Alch.*, Præf.).

He considers it a true art:

> 'Probat artem Alchimiæ esse veram' (*l.c.* c. 3).

He believes all metals can be transmuted into gold and silver, represented in astrological terms as Sun and Moon:

> 'Et ut breviter dicam, omnia metalla transubstantiantur in Solem et Lunam' (*ib.* c. 10).

He speaks of the Elixir:

> 'De his quatuor spiritibus fit tinctura quæ dicitur Elixir arabice, fermentum latine' (*ib.* c. 10).

Fermentation and chemical reaction seem to be used as equivalent terms.

7. **Thomas Aquinas** was the pupil of Albert the Great at Cologne and at Paris. He, like his master, was a member of the Dominican Order. He graduated at Paris, and taught not only at Cologne under Albert, but at Paris, at Rome, and at other cities in Italy. He refused the Archbishopric of Naples, and died at the Abbey of Fossa Nuova near Piperno on his way to the Council of Lyons in 1274. Ferguson, in his *Bibl. Chem.*, discusses the authenticity of the *Thesaurus Alchemiæ secretissimus ad fratrem Reinaldum* which is attributed to him, and leaves it an open question. The *Summa* contains one or two passages which directly or indirectly refer to alchemy, although his similes are drawn from animal and plant life rather than from the mineral world. The principle of the transmutation of metals may be inferred from one of the earliest definitions of the *Summa*:

> 'Respondeo dicendum quod solus Deus est omnino immutabilis, omnis autem creatura aliquo modo est mutabilis. Sciendum est enim, quod mutabile potest aliquid dici dupliciter. Uno modo per potentiam, quæ in ipso est. Alio modo per potentiam, quæ in altero est' (*Summa*, pt. i. qu. ix. art. ii.).

God alone is immutable; all else is mutable, in different ways. In one place Aquinas refers to the relation that exists between the minerals and the stars:

> 'Ad primum ergo dicendum, quod effectus aliquis invenitur assimilari causæ agenti dupliciter. Uno modo secundum

> eandem speciem, ut homo generatur ab homine, et ignis ab igne. Alio modo secundum virtualem continentiam: prout scilicet forma effectus virtualiter continetur in causa. Et sic animalia ex putrefactione generata, et plantæ et corpora mineralia assimilantur soli et stellis, quorum virtute generantur' (*Summa*, pt. i. qu. cv. art. i.).

In discussing the question of the sale of adulterated goods, he says that to sell gold and silver made by the alchemist, if it have not the nature of true gold and silver, is a fraudulent transaction. If, however, this gold of the alchemist is true gold, the transaction is lawful. He recognizes the possibility of fraud, but at the same time witnesses to his belief in the production of gold by the art of the alchemist. The passage is sometimes only partially quoted. It is of importance in its bearing on the alchemical knowledge of Thomas Aquinas:

> 'Ad primum ergo dicendum quod aurum et argentum non solum cara sunt propter utilitatem vasorum, quæ ex eis fabricantur, aut aliorum hujusmodi; sed etiam propter dignitatem et puritatem substantiæ ipsorum. Et ideo si aurum vel argentum ab alchimicis factum, veram speciem non habeat auri et argenti, est fraudulenta et injusta venditio; præsertim cum sint aliquæ utilitates auri et argenti veri, secundum naturalem operationem ipsorum, quæ non conveniunt auro per alchimiam sophisticato. Sicut quod habet proprietatem lætificandi, et contra quasdam infirmitates medicinaliter juvat. Frequentius etiam potest poni in operatione, et diutius in sua puritate permanet aurum verum quam aurum sophisticatum.'

This contrast between real gold and counterfeit gold implies some knowledge and experience of the art of alchemy:

> 'Si autem per alchimiam fieret aurum verum, non esset illicitum ipsum pro vero vendere, quia nihil prohibet artem uti aliquibus naturalibus causis ad producendum naturales et veros effectus: sicut August. dicit in 3. *de Trinit.* de his quæ arte dæmonum fiunt.'

The art of alchemy is not unlawful if it confine itself to the investigation of natural causes and natural effects, though some think it demoniacal (pt. ii. 2, qu. lxxvii. art. ii.).

8. **Roger Bacon**, born about 1214, spent his youth at Oxford before joining the Franciscan Order. He began his studies in alchemy and the kindred sciences before 1250, and by 1267 had spent more than 2000 libræ 'on secret books and various experiments and languages and instruments and tables.' He left Oxford for Paris some time before 1245, and returned to Oxford soon after 1250. About 1257 he was exiled, and placed under strict supervision at Paris for ten years. On June 22, 1266, Clement IV. wrote to him, bidding him send him his works secretly and without delay, notwithstanding any restrictions of the Order. Within fifteen or eighteen months he sent to the Pope the *Opus Majus*, the *Opus Minus*, and the *Opus Tertium*. By the Pope's influence he returned to Oxford and began to labour at a great Summa Scientiæ, the *Compendium Philosophiæ*. In 1278 he was condemned 'propter quasdam novitates,' and remained in prison for fourteen years. His last known work was written in 1292.

The *Opus Majus* is silent on the subject of alchemy. The *Opus Minus*, of which only fragments exist in the Bodleian (Brewer, *Opera Inedita*, 311–390), deals with practical alchemy in pt. ii., and speculative alchemy, or *de rerum generationibus*, in pt. v. There is no reference to it in the *Opus Tertium*, but in the *Compendium Philosophiæ* it is the subject of bk. iii. of vol. iii. Speculative alchemy, according to the definition of Roger Bacon, is the science of the generation of things from elements; practical alchemy teaches 'how to make noble metals and colours,' and 'the art of prolonging life.' Some other works of his on alchemy are regarded as genuine.

The different titles of the *Breve Breviarium* give some idea of the scope and aim of his work; it is entitled, *De naturis metallorum in ratione alkimica et artificiali transformatione*, or *Cœlestis alchymia*, or *De naturis metallorum et ipsorum transmutatione*. The date is uncertain. On the subject of old age is the *Libellus Rogerii Baconi . . . de retardandis senectutis accidentibus et de sensibus conservandis*. It is assigned to the year 1276. The *Antidotarius* is a second part of this work. The *De consideratione quintæ essentiæ*, the *Speculum alchemiæ*, *the Speculum secretorum*, the *Secretum secretorum naturæ de laude lapidis Philosophorum*, the *Semita recta alchemiæ*, and the *Thesaurus spirituum*, are wrongly attributed to Bacon (Little, 'The Grey Friars in Oxford,' *Oxf. Hist. Soc. Publ.* vol. xx. pp. 191–211).

9. The most prominent names among the alchemists of the last part of the 13th cent. are **Raymondus Lullius** and **Arnold of Villanova**. The former of these, the Raymond Lully of the later English alchemists, was born of noble parentage in Catalonia, and held, in his early years, a high position in the Court of Aragon. Disappointed in a romantic attachment, he renounced the world, and gave himself up to a life of study and mission work in Africa. His work witnesses to a remarkable combination of spiritual devotion and scientific research, with a passionate enthusiasm for the conversion of the Moors. He devoted himself at first to the study of Arabic. He undertook his first mission to Africa in 1271, but met with little success. He was at Paris in 1281, where he became acquainted with Arnold Villanova. In 1287 he visited Rome, and in 1291 Montpellier. During these years he wrote his great works, the *Ars Generalis sive Magna* and the *Libri xii. Principiorum Philosophiæ contra Averroistas*. In 1292 he went to Africa a second time, and was imprisoned at Tunis. In 1293 he was in Naples; and after journeying to Cyprus and Armenia he was again in Paris in 1308, where he is supposed to have met Duns Scotus. In 1309 he made another missionary journey to Africa, and succeeded in converting seventy disciples of Averroës at Bona, the ancient Hippo, the see of St. Augustine. Once again, as an old man of eighty, he made a last journey to Africa, in 1315, to be stoned and maltreated at Bugia. He lived only to see the shores of the island of Majorca, where he was buried in a chapel on one of his own estates. In his last will, the *Codicillus seu Vade Mecum quo fontes alchemicæ artis ac philosophiæ reconditioris traduntur*, he says that he converted 22 tons of quicksilver, lead, and tin into gold. The tradition that he was brought from Rome by Cremer, Abbot of Westminster, and that he coined the rose-nobles for Edward III., does not seem to rest on historical fact (Ferguson, *Bibl. Chem.*).

Arnold of Villanova, his contemporary, was probably also a Spaniard. He was born in 1245, and died in 1310. He studied amongst the Arabs of Spain; and it is stated, on the authority of John André, that he succeeded in the genuine conversion of iron bars into pure gold at Rome (*Bibl. Chem.* p. 95). At least these alchemists of the 13th cent. in their researches seem to have discovered the secret of a long and useful and strenuous life. Albert the Great died at the age of 87, Roger Bacon at about 78, Raymond Lully at 80, and Arnold Villanova at 65, at a period when the average life was not so long as it is now.

10. The most distinguished pupil of Lully and Villanova was **Pope John XXII.** (1316–1334), who also lived to the age of 90. He worked at alchemy in the Papal palace at Avignon, and is said to have left behind him 25,000,000 florins. At the same time he wrote a letter in which he censured the black magic which was practised 'in nostra curia' by certain clergy,—Joannes de Lemovicis, 'Jacobus dictus Brabantinus,' and a barber-surgeon, described as 'Joannes de Amanto, medicus,' or, in another place, 'barberius' (Raynald, *Ann. Eccl.* 1317, 53).

11. The practice of the art of alchemy was continued throughout Europe in the 14th cent. on the lines laid down by the masters of the 13th cent. John Cremer, Abbot of Westminster, after studying the art for thirty years, worked at Westminster in the reign of Edward III. (1327–1377). John

Rupecissa, or Jean de Roquetaillade, was a Franciscan of Aurillac in Aquitaine. He was imprisoned by Innocent VI. in 1356–1357. He quotes Geber, Lullius, and Villanova. In his *Liber lucis* is the picture of a furnace, in which was practised 'the incubation of the philosophic egg whence issued the marvellous quintessence.' **Petrus Bonus** of Ferrara was the author of the *Preciosa Margarita novella de Thesauro ac pretiosissimo Philosophorum Lapide*. It was written in 1330, and published at Venice in 1546. The term 'fermentum,' used by Albert the Great as the Latin of elixir, is applied by Petrus Bonus to the philosopher's stone. It is also used as the means of perfecting it:

> 'Apud philosophos fermentum dupliciter videtur dici: uno modo ipse lapis philosophorum et suis elementis compositus et completus in comparatione ad metalla; alio modo illud quod est perficiens lapidem et ipsum complens.'

The chemical reactions due to it are compared with the working of yeast:

> 'De primo modo dicimus quod sicut fermentum pastæ vincit pastam et ad se convertit semper, sic et lapis convertit ad se metalla reliqua. Et sicut una pars fermenti pastæ habet convertere partes pastæ et non converti, sic et hic lapis habet convertere plurimas partes metallorum ad se, et non converti' (Petrus Bonus, *ap*. P. Schützenberger, *On Fermentation*, p. 11). Schützenberger adds: 'This property of transmitting a force to a large mass without being itself weakened by the process was precisely that which ought to characterize the philosopher's stone, which was so much sought after.' Since these words were written, the discovery of radium has given to chemistry an element which also appears to have the property 'convertere plurimas partes metallorum ad se, et non converti.'

Nicolas Flamel belonged to the latter part of the 14th century. He was born in Pontoise about 1330, and died in 1418 at the age of 88. His discovery of the elixir of life in 1382 seems to have met with its reward.

12. Among the prominent names of the 15th cent. are **Basil Valentine** and **Isaac of Holland**. The former is considered the author of the *Triumphal Car of Antimony*, but there is considerable doubt as to the facts of his life and the authorship of the works attributed to him. The chief fact is a record in an Erfurt Chronicle under the year 1413: 'Eadem ætate Basilius Valentinus in Divi Petri monasterio vixit.' There is a similar doubt as to the identity of Isaac of Holland. The life of **Bernard, Count of Treviso**, covers the whole century. Born in 1406, he died in 1490 at the age of 84, another instance of the secret of long life won by the alchemists probably by means of study, method, and application to work. He distinguishes between the results of the labour of the true alchemist and the counterfeit products of sophistical alchemists. Here there is some echo of the phrase of Thomas Aquinas: 'aurum sophisticatum.'

England produced three prominent alchemists in this century. **George Ripley** was born about 1415, and was a Canon Regular of St. Augustine at Bridlington. He visited Rome in 1477, and returned in 1478 after having discovered the secret of transmutation. He is the author of *The Compound of Alchemy, or the Ancient Hidden Art of Alchemie: Containing the right and perfectest Means to make the Philosopher's Stone, Aurum potabile, with other excellent Compounds*. His Twelve Gates of Alchemy give some insight into the methods of the art in England in the 15th century. They are: Calcination, Solution, Separation, Conjunction, Putrefaction, Congelation, Cibation, Sublimation, Fermentation, Exaltation, Multiplication, Projection. He died in 1490 at the age of 75. **Thomas Dalton** lived in the middle of the century, and received a powder from a Canon of Lichfield under a promise not to use it until after his death. **Thomas Norton** of Bristol wrote his *Crede Mihi*, or *Ordinal of Alchemy*, in 1477. He says:

> 'I made also the Elixir of life,
> Which me bereft a merchant's wife:
> The Quintessens I made also,
> With other secrets many moe,
> Which sinful people took me fro
> To my great pain and much more woe.'

13. The 16th cent. saw a further development of alchemy into the more exact sciences of chemistry and medicine. **Paracelsus**, in his student wanderings an alchemist, became by practice a physician, by experience a chemist. He was at once adept and wizard, sceptic and critic. He wrecked his work by his bombast, his life by his self-indulgence. At the same time, to use Browning's words, 'the title of Paracelsus to be considered the father of modern chemistry is indisputable.' Gerardus Vossius says of him: 'Nobilem hanc medicinæ partem, diu sepultam avorum ætate, quasi ab orco revocavit Th. Parcelsus' (*de Philosophia et Phil. sectis*, ix. 9). It appears also from his treatise *de Phlebotomia* that he had discovered the circulation of the blood. Lavater says that 'though an astrological enthusiast,' he was 'a man of prodigious genius' (*de Natura Rerum*, Holcroft's tr., vol. iii. p. 179). There is a reference to his use of laudanum on the evidence of his secretary, Oporinus:

> 'Alii illud quod in capulo habuit, ab ipso Azoth appellatum, medicinam fuisse præstantissimam aut lapidem Philosophicum putant' (Melch. Adam). Browning adds: 'This famous sword was no laughing matter in those days, and it is now a material feature in the popular idea of Paracelsus. . . . This Azoth was simply "laudanum suum." But in his time he was commonly believed to possess the double tincture—the power of curing diseases and transmuting metals. Oporinus often witnessed, as he declares, both these effects, as did also Franciscus, the servant of Paracelsus, who describes, in a letter to Neander, a successful projection at which he was present, and the results of which, good golden ingots, were confided to his keeping.'

Paracelsus, otherwise Philippus Aureolus Theophrastus Bombastus ab Hohenheim, was born at Einsiedeln in 1493. He studied medicine under his father at Villach, and alchemy under Tritheim, Bishop of Spanheim, at Würzburg. The character of his studies at Würzburg is best seen in the letter dedicatory, written in 1510, by Agrippa to Tritheim:

> 'Quam nuper tecum, R. P. in cœnobio tuo apud Herbipolim (Würzburg) aliquandiu conversatus, multa de chymicis, multa de magicis, multa de cabalisticis, caeterisque quæ adhuc in occulto delitescunt, arcanis scientiis atque artibus una contulissemus,' etc.

It was partly in rebellion against these traditional methods, partly to gain as wide an experience as possible, that Paracelsus spent his early life in travel:

> 'Patris auxilio primum, deinde propria industria doctissimos viros in Germania, Italia, Gallia, Hispania, aliisque Europæ regionibus, nactus est præceptores' (Melch. Adam, in *Vit. Germ. Medic.*). The passage illustrates the wide interest in alchemy throughout Europe at the close of the 15th century.

Under the patronage of Sigismond Fugger, Paracelsus learnt much in the mines of Bohemia, and himself speaks of his researches into folk-lore:

> 'Ecce amatorem adolescentem difficillimi itineris haud piget, ut venustam saltem puellam vel fœminam aspiciat' (*Defensiones Septem adv. æmulos suos*, 1573: 'de peregrinationibus et exilio').

In 1526 he was called to a chair of physic and surgery at Basel. Here his over-bold denunciation of Avicenna and Galen made him many enemies. In 1528 his fall was brought about in the case of a canon of Basel named Liechtenfels. This man was cured by Paracelsus, but refused to pay the recognized fee. His refusal was supported by the magistrates, and Paracelsus fled to Colmar. He was at Nuremberg in 1529, at St. Gall in 1531, at Pfeffers in 1535, and at Augsburg in 1536. He then visited Moravia, Arabia, and Hungary. In 1538, when at Villach, he dedicated his 'Chronicle' to the States of Carinthia, in gratitude for the many kindnesses with which they had honoured his father. He died at Salzburg in 1541, at the early age of 48. He seems to have been generous in the practice of medicine. His epitaph says of him: 'Bona sua in pauperes distribuenda collocandaque erogavit.' A sceptic and fierce critic in alchemy, he appears to have been no less so in theology. Quenstedt says of him: 'Nec tantum novæ medicinæ, verum etiam novæ theologiæ autor est' (*de Patr. Doct.*). Delrio places him among those who were: 'partim atheos, partim hæreticos' (*Disquis. Magicar.* i. 3). At the same time, Browning is justified in the last words he places in the mouth of Paracelsus:

> 'If I stoop
> Into a dark tremendous sea of cloud,
> It is but for a time; I press God's lamp
> Close to my breast; its splendour, soon or late,
> Will pierce the gloom: I shall emerge one day.
> You understand me? I have said enough?'

An inventory taken at his death shows that the only books he left were the Bible, the New Testament, the Commentaries of St. Jerome on the Gospels, a printed volume on medicine, and seven manuscripts. His works were published by F. Bitiskius in 3 vols. fol. in 1658; the Hermetic and Alchemical writings by A. E. Waite in 2 vols. in 1894. Jules Andrieu says of him: 'He is the pioneer of modern chemists, and the prophet of a revolution in general science' (*Encyc. Brit.* art. 'Alchemy'). Browning sums up his study of Paracelsus in the words:

> 'Meanwhile, I have done well, though not all well.
> As yet men cannot do without contempt;
> 'Tis for their good, and therefore fit awhile
> That they reject the weak, and scorn the false,
> Rather than praise the strong and true, in me:
> But after, they will know me.'
> (*Paracelsus*, 1835, and notes).

The new influence in the 16th cent. is shown by the violent death of Beuther, who was alchemist to the Elector Augustus of Saxony from 1575 to 1582, and in the title of Libavius' great work published in 1595—*Alchymia recognita, emendita, et aucta.* It has been called the 'first text-book of chemistry.' It contains a chapter on the philosopher's stone. In England, Thomas Charnock published his *Breviary of Philosophy* in 1557, his *Exigue of Alchemy* in 1572, and his *Memorandum* in 1574. He was instructed in the use of gold-making powder by Bird, who received it from Ripley. It was only those who were well-to-do who could carry on these experiments. The furnace alone cost Charnock £3 a week. The *Alchemical Testament* of John Gybbys of Exeter in the time of Elizabeth has been published by James O. Halliwell (London, 1854).

There does not seem to have been much interest taken in alchemy at Oxford in the early part of the century. The Day Book of John Donne in 1520 contains but few references to alchemical works. There is one copy of the *Commentum Arnoldi de Villanova* (fol. 3, a. 1); there are three copies of a *Chiromantia de manu* (fols. 1. a. 1, 8. b. 2, 13. a. 1), and two copies of Albertus, *de mineralibus* (13. a. 1, 13. b. 2). There is also a copy of *Theoretica planetarum* (15. b. 1) (Fletcher, *Collectanea Oxf. Hist. Soc.* vol. v. p. 71 ff.). In the catalogue of books belonging to William Grocyn, drawn up by his executor, Linacre, in the same year, there is the same absence of such books (Mont. Burrows, *Collect. Oxf. Hist. Soc.* vol. xvi. p. 317 ff.). Oxford had at this time other interests, especially the new learning associated with the names of Grocyn, Linacre, Foxe, and others. The training of Linacre, the founder of the English College of Physicians, the friend of Politian and Chalcondylas, and the great Venetian publisher, Aldus Manutius, is in marked contrast to the restless wanderings of Paracelsus.

14. It was long before the new sciences cut themselves altogether adrift from the ideas of the alchemists. In the early part of the 17th cent. the brotherhood of the Hermetic philosophers known as the Rosicrucians (wh. see) brought the occult mysteries of the earlier alchemists again into notice. The brotherhood claimed descent from Christian Rosencreutz in 1459; but no evidence for this exists beyond their own publications. The controversy centred round a work entitled, *Chymische Hochzeit Christiani Rosencreutz anno 1459*, written by Johann Valentin Andreä in 1616, and published at Strassburg. Among the most prominent of the Rosicrucian brotherhood was Michael Maier, physician to the Emperor Rudolph II. (1576–1612). He published *Examen fucorum Pseudochymicorum* in 1617, *Atalanta fugiens* in 1618, *Symbola aureæ mensæ* in 1617, and the *Tripus aureus* containing three treatises—the *Basilii Valentini Practica ex Germanica*, the *Crede Mihi seu Ordinale* of Thomas Norton, and the *Testamentum* of Cremer, Abbot of Westminster. Robert Fludd introduced the brotherhood to the notice of English physicians. Born in Kent in 1574, he matriculated at St. John's, Oxford, on November 10, 1592, and took his M.A. degree in 1598. One of the three questions discussed by him for Inception in Medicine in 1605 was: 'Chymicum extractum minus molestiæ et periculi affert quam quod integrum et naturale' ('Reg. Univ. Oxon.,' *Oxf. Hist. Soc.* vol. ii. pt. i. 193, ii. 191, iii. 194). In the same year is discussed in Comitiis: 'Incantatio non valet ad curam morbi.' Fludd went abroad and studied the works of Paracelsus and the mysteries of the Rosicrucians. On his return he practised as a physician in London, and died in 1637.

The Hon. Robert Boyle, one of the first promoters of modern chemistry, and a leading member of the Royal Society on its incorporation in 1662, believed in the transmutation of metals. In 1659 he brought to Oxford 'the noted chemist and Rosicrucian, Peter Sthael of Strasburgh.' Anthony Wood began a 'course of chemistry' under him April 23, 1663, paying 30s. in advance, and the balance of 30s. at the conclusion of the class, May 30, 1663. 'A. W. got some knowledge and experience; but his mind was still busy after antiquities and music.' Among the members of this famous chemistry class at Oxford was 'John Lock, a man of turbulent spirit, clamorous, and never contented,' and 'Mr. Christopher Wren, afterwards a knight, and an eminent virtuoso.' In 1664, Mr. Sthael was called away to London, and became operator to the Royal Society; and continuing there till 1670, he returned to Oxford in November. (Clark, 'Wood's Life and Times,' *Oxf. Hist. Soc.* vol. xix. pp. 290, 472). The *Sceptical Chemist*, by Robert Boyle (Oxford, 1680), contains the first statement of the molecular or atomic idea in chemical philosophy (H. C. Bolton, *Catalogue of Works on Alchemy and Chemistry*, exhibited at the Grolier Club, New York, 1891). He was made 'Dr. of Phisicke' in 1665, and died in 1691.

The Rosicrucian ideas and alchemistical methods survived to some extent at Oxford. Elias Ashmole was the contemporary of Robert Boyle at Oxford, but as a member of Brazenose, and not as 'a sojourner.' In 1650 he edited a work of Dr. John Dee, who died *c.* 1608, of whom Wood says: 'I have heard some say that he was a mere mountebank in his profession' ('Wood's Life and Times,' *Oxf. Hist. Soc.* vol. xix. p. 308). In 1654, Ashmole wrote *The Way to Bliss in three books.* 'The author says that motion is the father of heat, and doth beget and purchase it of nothing, theoretically anticipating modern doctrines' (Bolton, *Catalogue*). Bk. iii. ch. ii. treats of the Philosopher's Stone. In 1677 he offered his curios and MSS to the University, on the condition that it would build a Museum and Chemical Laboratory. The foundation-stone was laid September 14, 1679, and the building was finished March 20, 1682–1683.

The inscription describes this first public laboratory in Oxford: 'Musæum Ashmoleanum: Schola Naturalis Historiæ: Officina Chemica.' The three largest rooms were public: 'The uppermost . . . *Musæum Ashmoleanum*. The middle room is the *School of Natural Historie*, where the professor of chymistry, who is at present Dr. Robert Plot, reads three times a week. The lower room, a cellar . . . is the Laboratory, perchance one of the most beautiful and useful in the world' ('Wood's Life and Times,' *ib.* vol. xxvi. p. 55).

It was thus under the direction of Ashmole, perhaps the last of the Oxford alchemists, that the study of chemistry was placed on a sound and public footing. Ashmole died in June 1692, a year after Robert Boyle.

In the sister University, at the same period, Newton, who became Fellow of Trinity in 1667, directed his studies for some little time to alchemistical methods, and investigated the Philosopher's Stone. But at Cambridge, as at Oxford, the newer scientific methods set aside the dreams and theories of the older alchemists, and opened the way to modern chemistry.

15. In the 18th cent. alchemy was finally discredited in the person of Dr. Price of Guildford, the last of the alchemists, a distinguished amateur chemist, and Fellow of the Royal Society. In May 1782 he professed to transmute mercury into silver and gold in the presence of a select company. Some of the gold thus obtained was presented to George III., and Price was made M.D. of Oxford. The Royal Society then pressed him to repeat the experiments in their presence. He hesitated, refused, and only on the pressure of the President, Sir Joseph Banks, at last reluctantly consented. He withdrew to Guildford, prepared an ample amount of laurel water, and then began to manufacture his projection powder. On the 3rd of August he invited the Royal Society to Guildford. Only three Fellows responded to the invitation. He received them, and then committed suicide in their presence.

In Germany, alchemy was laughed out in the person of Semler. He received the 'Salt of Life' from Baron Hirschen, and, treating it as the Philosopher's Stone, was surprised to find gold deposited in the crucible. Klaproth analyzed the 'Salt of Life,' and found it to consist of Glauber's salt and sulphate of magnesia. In the 'Salt' sent by Semler, however, Klaproth discovered gold, though not in combination. Klaproth again consented to analyze Semler's solution before the Court, when, instead of gold he found a kind of brass called tombac. On further investigation, it was discovered that Semler's old servant, eager to humour his master, had slipped pieces of gold leaf into Semler's chemical mixtures. The servant entrusted the secret to his wife, that in his absence she might purchase the gold leaf as before. She, however, bought brass instead of gold, and spent the balance on drink. In this way alchemy was laughed out of Germany (Chambers, *Book of Days*, i. 602).

The theories of the alchemists did not die out at once. They were still held by the adepts at the close of the 18th century. The Antiquary says that Dousterswivel 'exhibits himself as a perfect charlatan—talks of the *magisterium*—of sympathies and antipathies—of the cabala—of the divining-rod—and all the trumpery with which the Rosicrucians cheated a darker age, and which, to our eternal disgrace, has in some degree revived in our own' (Scott, *Antiquary*, ch. xiii.). The *Lives of the Adepts in Alchemystical Philosophy* was published in London in 1814, and contained reports and extracts of many works on alchemy. Bulwer Lytton's *Zanoni* was written in 1842 as a study in the mysteries of the Rosicrucians.—George Eliot in 1871 wrote: 'Doubtless a vigorous error vigorously pursued has kept the embryos of truth a-breathing: the quest of gold being at the same time a questioning of substances, the body of Chemistry is prepared for its soul, and Lavoisier is born' (*Middlemarch*, vol. iii. ch. xlviii.).

16. But it was the establishment of the Atomic Theory by Dalton in the beginning of the 19th cent. as a working hypothesis in practical chemistry that set on one side the theories of the alchemists:

The observation of the Law of Equivalents and the Law of Multiples 'led to the idea that the elementary bodies are made up of indivisible particles called *atoms*, each having a constant weight peculiar to itself; and that chemical combination takes place by the juxtaposition of these atoms, 1 to 1, 1 to 2, 1 to 3, 2 to 3, etc., a group of atoms thus united being called a *molecule*. This is the atomic hypothesis of Dalton' (H. Watt, *Inorganic Chemistry*, 1883, p. 267).

Immutability has been the recognized law of the elements:

'Our molecules, on the other hand, are unalterable by way of the processes which go on in the present state of things, and every individual of each species is of exactly the same magnitude. . . . In speculating on the cause of this equality, we are debarred from imagining any cause of equalization, on account of the immutability of each individual molecule. It is difficult, on the other hand, to conceive of selection and elimination of intermediate varieties, for where can these eliminated molecules have gone to, if, as we have reason to believe, the hydrogen, etc., of the fixed stars is composed of molecules identical in all respects with our own?' (Clark-Maxwell, *Theory of Heat*, 1885, p. 331).

Thus, under the most advanced theory of Chemistry and Physics in the 19th cent., the transmutation of elements was inconceivable. Yet there were masters of chemical philosophy who entered a caution against the exclusion of possibilities.

Tilden writes: 'The molecular theory has been adopted in a somewhat rigid form, not by reason of any special conviction of my own regarding its permanence as a scientific truth, but because I am satisfied by long experience that, whatever form it may ultimately assume, it is even now a most important and almost indispensable aid to teaching chemistry' (*Introd. to Chemical Philosophy*, London, 1876, p. vii). In treating of the Periodic Law and Mendelejeff's Table, he says: 'This table requires a few remarks. In the first place, there are some elements, as, for instance, copper, silver, and gold, for which a place cannot readily be found. Silver is undoubtedly allied, though not very closely, with sodium, whilst it is also connected with copper on the one hand and with mercury on the other. Gold again is unquestionably triad, whilst the platinum metals to which it is most nearly related exhibit even atomicity' (*ib* p. 243). There still remained something behind which was not altogether clear, and this, too, in the important metals, silver and gold.

17. The discoveries of the Becquerel rays and the isolation of the element radium by M. and Mme. Curie in the opening years of the 20th cent. have opened up far-reaching possibilities, and have induced many leading chemists to conceive the idea of the transmutation of the elements. At the Leicester Meeting of the British Association on Aug. 1, 1907, Lord Kelvin challenged these inferences. He maintained that it was almost absolutely certain that there are many different kinds of atom, each eternally invariable in its own specific quality, and that different substances, such as gold, silver, lead, iron, etc., consist each of them of atoms of one invariable quality, and that any one of them is incapable of being transmuted into any other. He thus combated the recent assertion regarding the transmutation of metals, and continued to regard an atom as the ultimate indivisible unit of matter, and the electron, or electrion, as an electrical atom.

The discussion on 3rd Aug. 1907 was an event in the history of chemical science. Professor Rutherford, in opening the debate, held that the discovery of the electron had not as yet disproved the atomic theory. All attempts to find an electron with a positive charge of electricity had failed. 'Though we can liberate the electrons of matter very freely, there is no evidence that the liberation of the electron tends to the disintegration of an atom.' Sir William Ramsay, as a chemist, disagreed with Lord Kelvin and Professor Rutherford. The latter had said that there was no evidence that the loss of electrons altered the atom. Perhaps not. *But there was evidence that the gain of electrons did so.* He declared that, by placing radium hermetically closed in a glass vessel, the electrons, emanating from the radium through the glass, and falling on a nickel bar placed in juxtaposition, had the effect, after a certain time, of covering the bar with a film of radio-active matter, which could be separated by chemical treatment. His conclusion was that some kind of transmutation took place, converting the nickel into some other substance, this being characterized by its radio-activity. Lord Kelvin, in his reply, said that the discovery of the properties of radium had been most suggestive, and had opened our eyes to other discoveries, never suspected or dreamed of. Sir William Ramsay then announced a further discovery. He had proved that when radium was isolated in a bottle, after a lapse of time it gave off an emanation, and the new gas helium. When again that emanation was isolated, it produced helium and something else, which is conjectured on possible grounds to be lead. Again, when that emanation was dissolved in copper solution it produced the new element called argon, but now, when the radium emanation was dissolved in water, and the gases were extracted from the water, the resulting production was not helium, but its kindred element neon. These marvellous properties of radium thus described by Sir William Ramsay seem almost to realize the ancient dreams of the alchemists. Has it after all been reserved for the chemists of the 20th cent. to find in radium the Philosopher's Stone, and to prove it to have the power of transmuting yet unknown elements into gold?

LITERATURE.—M. Berthelot, *Les Origines de l'Alchimie*, Paris, 1885; J. Ferguson, *Bibliotheca Chemica: a Catalogue of the Alchemical, Chemical, and Pharmaceutical books in the Collection of the late James Young of Kelly and Durris, Esq.*, 2 vols., Glasgow, 1906; H. C. Bolton, *Catalogue of works on Alchemy and Chemistry exhibited at the Grolier Club*, New York, 1891; Anon., *Lives of the Adepts in Alchemystical Philosophy*, London, 1814; A. E. Waite, *The Hermetic and Alchemical Writings of Philippus Aureolus Theophrastus Bombast, of Hohenheim, called Paracelsus the Great*, 2 vols., London, 1894.

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ALCHERINGA.—The name applied by the Arunta, Kaitish, and Unmatjera tribes of Central Australia to the mythical past in which their ancestors were formed, and their ceremonies and regulations instituted. According to Spencer-Gillen (*Nor. Tr.* p. 745), the word *alcheri* means 'dream' (but cf. *FL* xvi. 430), and *Alcheringa* is equivalent to 'Dream Times.' Analogous beliefs are found in other tribes to the north of the Arunta; the Warramunga term corresponding to *Alcheringa* is *Wingara.*

1. In the Alcheringa existed at the outset, according to the Arunta myth, the ancestors whose spirits they regard as incarnated in the men of the present day; they were at most semi-human, but possessed more than human powers, and are credited with the formation of natural features such as the Macdonnell Ranges; in the Alcheringa period these amorphous *inapertwa*, who were transformed into human beings and later underwent initiation ceremonies, travelled over the country in totem companies, each carrying a *churinga* (see AUSTRALIANS), and at the spots where they camped are the present *oknanikilla*, or local totem centres. The Arunta distinguish four Alcheringa periods: (*a*) creation of man from the *inapertwa*; (*b*) institution of circumcision with the stone knife; (*c*) of the *ariltha* or mica operation; (*d*) of regulations regarding marriage. Originally the country was covered with salt water, which was withdrawn towards the north; two *ungambikula* (='self-existing') in the western sky saw to the east some *inapertwa*; with their knives they released the half-formed arms and legs, slit the eyelids and so on; after circumcising the men they became lizards. Some of the uncircumcised men were eaten by *oruncha* (evil spirits), who were killed by men of the lizard totem. In the next two stages an *oknirabata* (sage) introduced circumcision with the stone knife, and taught the little hawk totem group to perform the operation; they also formed the four intermarrying classes, but without associating them with marriage regulations. More *inapertwa* were transformed; men of the wild cat totem instituted the mica ceremony, and the order of the initiation ceremonies was arranged. Finally, the Emu people introduced the present marriage restrictions. According to the Unmatjera and Kaitish, the *inmintera* (the Arunta *inapertwa*) were formed into human beings by an old crow; he returned to get his stone knife with which to circumcise them, and in his absence two lizard men from the south circumcised and subincised the men, and performed the corresponding operation on the women. Another Kaitish tradition makes the transformers two boys to whom Atnatu (a god) sent down stone knives. Some of the ancestors were men (*ertwa*) when they were first formed. In the Kaitish tribe the travels of the groups of totemic ancestors are almost wanting, or possibly forgotten; the various spots are said to have been peopled by one or two ancestors, who sometimes carried *churinga.*

2. The Urabunna, the neighbours of the Arunta on the other side, also have their mythic period, named Ularaka; the ancestors of the totemic groups were semi-human and lived on the earth or beneath it; they had superhuman powers. The ancestors of each totemic group at the present day were few in number, and there is no myth of the *churinga* being carried. The Urabunna belief thus differs widely from that of the Arunta and Kaitish, and comes near that of the Warramunga (see below). The semi-human ancestors wandered about the country putting *mai-aurli* (spirit individuals) into rocks and pools, and these subsequently became men and women, who formed the first totem groups. These *mai-aurli* are continually undergoing re-incarnation; as a rule, with the Arunta they inhabit different localities according to their totem; but in the Urabunna and other tribes those of two or more totems may inhabit the same place. Each re-incarnated individual is held to change his phratry, totem, and sex on re-incarnation; after death he goes back to the spot where he was left in the Ularaka, and this regardless of the totem to which he may for the time being belong. In the Wonkgongaru tribe, north-west of Lake Eyre, the Urabunna beliefs prevail, with the exception that they accept the Arunta belief as to the *inapertwa.*

3. The Unmatjera hold that every totemic ancestor had his class as well as his totem; the totem changes in their belief, as in that of the Arunta, in successive incarnations, the class seldom or never.

4. The Warramunga, Walpari, Tjingilli, and other tribes hold that every one is the incarnation of a Wingara ancestor; but these latter are regarded as having been fully formed men, and all the members of a totemic group at the present day are looked on as the descendants of one ancestor who wandered over the country leaving spirit children in trees and rocks; they believe that if a woman strikes one of these trees with an axe, the spirit child will enter her body. The ancestor began his travels under ground, and then came up to the surface; *churinga* are known in this tribe, but not associated with individuals. These beliefs are shared by the Umbaia and Gnanji, but the latter hold that women have no *moidna*, or spirit part; consequently spirit female children, though they exist, do not take human form. The Binbinga also hold that one totemic ancestor formed members of a group, and left Ulanji spirits which emanated from his own body.

5. In the Arunta tribe at the present day a man marries a woman of his own or any other totem; in the other tribes totemic exogamy is enforced. Tradition says that in the Alcheringa times men invariably married women of their own totem; the classes, too, were originally non-exogamous, and the present regulations came down from the north. It seems clear that the progress of social changes from north to south corresponds with the facts; but there is much division of opinion as to the value of the remainder of the myths. They are treated as mere ætiological myths by Andrew Lang and others, as genuine historical traditions by Spencer and others. It seems clear that some part of them cannot be historically true; for the totem groups are represented as living exclusively upon their totems; and some of these, such as grubs and plants, are not in season for more than a portion of the year.

LITERATURE. — Spencer - Gillen, *Native Tribes*, 1899, pp. 119-127, 387-422, *Northern Tribes*, 1904, pp. 145-175, etc. *FL* xvi. 428-433, gives the views of the Southern Arunta. For remarks on the Alcheringa legends see Lang, *Social Origins*, 1903, and *Secret of the Totem*; Durkheim's art. in *ASoc* iii. (1901) 20, etc.; see also Van Gennep, *Mythes et Légendes d'Australie*, 1906, p. xliv f.

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